



A property rights approach to strategy

Strategic Organization

10(4) 366–383

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DOI: 10.1177/1476127012457982

soq.sagepub.com



Guilherme Fowler de Avila Monteiro

Inspier Institute of Education and Research, Brazil

Décio Zylbersztajn

University of Sao Paulo, Brazil

Abstract

This article is about how resources can be conceptualized as bundles of attributes for which one can assign economic property rights. Strategic considerations are deliberately incorporated into the analysis through the assessment of the activities of capture and protection of property rights, along with the examination of the institutional environment. These basic elements combine in order to design an approach to strategy. In developing this approach, the authors identify four key questions for structuring the strategy formulation process of the firm. The analytical framework is illustrated through a particular case: the collection of royalties on the genetically modified (GM) technology in soybean seeds.

Keywords

Property rights, resource-based view, strategy

Introduction

The present article proposes that property rights logic can generate insights into the study of strategy which cannot be generated from received strategic approaches. Specifically, the article places the economic analysis of property rights (Barzel, 1994, 2005 [1997]) within a broader perspective, examining its relationship with the resource-based view (Barney, 1991; Peteraf, 1993; Rumelt, 1984; Wernerfelt, 1984). In doing so, the article contributes to the evolving construction of a strategic theory of the firm, reframing the question of competitive advantage through the assessment of the activities of capture and protection of economic property rights, along with the examination of the institutional environment.

As defined by Foss (2005: 24), a strategic theory of the firm should address four issues: (1) the existence of the firm (why do firms exist as distinct mechanisms for resource allocation?); (2) the boundaries of the firm (what explains why certain transactions are governed within the firm and others are governed by market relations?); (3) the internal organization (why are there different types of organizational structures?); and (4) the competitive advantage (which factors are responsible for the firm's ability to obtain economic rents?).

According to Foss (2005), the first three issues have been addressed historically by organizational economics. This branch of the literature encompasses a heterogeneous set of theories, especially transaction cost economics (Williamson, 1996), the property rights approach as developed by Grossman, Hart and Moore (Grossman and Hart, 1986; Hart, 1995; Hart and Moore, 1990) and agency theory (Holmström, 1979, 1982; Holmström and Milgrom, 1991, 1994). Under the auspices of organizational economics, strategic problems are fundamentally related to the reduction of incentive conflicts through ex-ante contractual alignment or ex-post governance mechanisms.

The examination of competitive advantage (4), in turn, is the major object of study of another branch of the strategy literature. Among different approaches, the resource-based view (RBV) is said to be the dominant contemporary approach to the analysis of sustainable competitive advantage (Foss, 2005). According to RBV, a firm has competitive advantage when establishing a strategy of value creation that is not simultaneously implemented by any competitor. Moreover, such competitive advantage is sustainable when effective or potential competitors are unable to duplicate the benefits associated with the strategy (Barney, 1991). The major differences in performance between firms are then explained in terms of differential efficiency of the resources that support strategic actions.

It is noteworthy that albeit being dominant, RBV is not free from criticism. As will be argued in the second section of this article, even in situations in which firm resources meet the conditions prescribed by the theory as sufficient for the sustainable competitive advantage to emerge, the institutional details of property rights might prevent the actual creation of value (Kim and Mahoney, 2002, 2007). Accordingly, RBV allows the examination of potential value creation, leaving open the question of creating real value. In order to analyze the ability of resource owners to create real value, one should be aware of the economic property rights agents have control of and how well these rights are delineated.

With the purpose of deepening the current understanding on competitive advantage, the present article examines a specific economic approach to property rights (Barzel, 1994, 2005 [1997]) and critically discusses how strategic aspects may be incorporated into the analysis. The article introduces three propositions as well as a list of four questions to guide how property rights might influence strategy. Proposition 1 asserts that economic property rights can be assigned for each attribute that encompasses a resource. The second proposition asserts that different protection efforts may be associated with the same resource, depending on the attribute that one intends to protect. Finally, proposition 3 asserts that the protection and capture of economic property rights are embedded in the institutional environment, which corresponds to a parameters that may shift the strategic equilibrium. These three propositions imply four questions that should come to mind when determining a strategy:

1. What are the valuable attributes of the organizational resources?
2. Which elements influence the firm's ability in appropriating the created value?
3. What are the protection strategies that may be associated with each valuable attribute?
4. How can the institutional environment influence the relative efficacy of capture in relation to protection of economic rights?

The analytical framework introduced in this article is then illustrated by means of a particular case: the collection of royalties on the genetically modified (GM) technology in soybean seeds. In general terms, any seed may be interpreted as a technology vector composed of different characteristics, the GM seed being a specific case where one or more seed attributes are not

normally attainable by the species under natural conditions. Since genetic traits may result from R&D efforts made by different firms, the seed plays the role of a complex resource. Accordingly, a GM seed corresponds to a good example of a strategic resource in the sense that its multiple attributes are easily described and may be associated to distinct strategic formulations.

The present article is organized as follows. The next section is a review of the literature. The third section examines a specific strategic approach based on property rights, while the fourth section applies the approach to the collection of royalties on GM soybean seeds. The article ends with conclusions and some perspectives for future research.

Literature review

The literature on the relationship between the resource-based view and the theory of property rights (Alchian, 1965; Barzel, 1994, 2005 [1997]; Coase, 1960; Cheung, 1969; Demsetz, 1967) is recent. Kim and Mahoney (2002) establish a relationship between these two approaches from a specific case, emphasizing the role that property rights can play in the assessment of value creation. Foss and Foss (2005), on the other hand, offer a more theoretical contribution by examining the relationship between transaction costs and RBV. In this section, we briefly review the key elements of both analyses.

Kim and Mahoney (2002) examine the relationship between property rights and RBV through the case of oil field unitization. In general, crude oil extraction is economically costly because crude oil is embedded in porous rock with low compressibility, so that oil cannot be self-expelled from the soil. In the early stages of the life of an oil field, the extraction is relatively easy; however, in later stages, gas and water should be injected into a well to force out the crude oil through another well.

Analyzing the situation from a resource-based perspective, Kim and Mahoney (2002, 2007) apply the approach developed by Peteraf (1993) for the examination of oil lease. Peteraf (1993) determines the four cornerstones of competitive strategy: (1) heterogeneity of the resource, (2) ex-post limits to competition, (3) ex-ante limits to competition and (4) imperfect mobility of the resource. Kim and Mahoney (2002) show that an oil lease meets each of these conditions, so that it may be classified as a source of sustainable competitive advantage.

Quite surprisingly, however, the authors note that the above conditions characterize a situation of potential creation of value. The exploitation of oil fields presents a classic pool dilemma (i.e. tragedy of the commons). In general terms, the crude oil tends to move within its underground reservoir so that an individual can extract oil in his or her territory and such oil may come from the property of another individual. This situation is not illegal since ownership to crude oil is assigned only after its extraction. This being the case, each owner does not consider the externality generated to other producers when maximizing his or her oil extraction.

Although a contractual solution to the common-pool problem can be designed – unitization agreement¹ – the existence of contractual incompleteness prevents the solution being adopted. Kim and Mahoney (2002, 2007) conclude that it can be difficult to establish the institutional details of property rights to the actual creation of value. The basic theoretical point is that value creation is critically informed by an analysis of property rights. The theory of property rights enables RBV to move beyond the generation of potential value, enabling the analysis of issues associated with the generation of realized value.

On a more theoretical perspective, Foss and Foss (2005) also investigate the relationship between property rights and RBV. The authors ask what would happen to the value of the resource

and to resource-based strategies in a world with zero transaction costs (Coase, 1960), and then discuss the implications of introducing transaction costs.

Foss and Foss (2005) start from the assumption that resources are composed of multiple attributes, which are defined as different services that a resource may provide (Penrose, 1959). Property rights can be assigned to each attribute of a resource,² consisting of the right to consume, obtain income and dispose of the resource attributes.³ According to the authors, property rights are important to strategy because the ability of resource owners to create, appropriate and maintain the value associated with the attributes of the resource depends, at least partially, on the property rights that the agent has control of and how well these rights are protected.

It is interesting to note that within the framework developed by Foss and Foss (2005), the issue of value dissipation becomes central. Dissipation can occur because either the protection of property rights is costly, or the absence of protection induces agents to spend resources on (expensive) activities to capture property rights. In any case, the protection and the capture of rights reduce the realized value, generating a gap between the potential and the actual value of a resource (Kim and Mahoney, 2002). Moreover, if capture activities are sufficiently intense, indirect dissipation emerges in the form of a reduced volume of market transactions. In strategic terms, the existence of direct and indirect dissipation represents an opportunity of value creation (Foss and Foss, 2005).

The above discussion highlights the fact that the application of the theory of property rights to competitive strategy is primarily associated to the problem of value appropriation. One may note that this issue is not new in the strategy literature. To some important extent the appropriability issue is the main theme of two fundamental references. Williamson (1985, 1996) analyzes the selection of governance mechanisms in face of the possibility of holdup associated with asset specificity. Teece (1986), on the other hand, investigates the reasons why an innovator is not always able to sustain the advantages related to the introduction of an innovation. These contributions, however, neither establish a direct dialog with the RBV, nor explicitly address the question of competitive position, being more focused on the boundary of the firm.

The debate about the relationship between the theory of property rights and RBV has evolved in order to investigate the role of the entrepreneur in the process of value creation. Kim and Mahoney (2006) claim that the arguments developed by Foss and Foss (2005) can be extended to include more dynamic aspects of resource utilization, specifically the dynamic search of entrepreneurial income. Foss and Foss (2006), in turn, argue that property rights, along with the transaction costs involved in defining and securing property rights, influence the entrepreneur's expectations regarding the value of the attribute that he or she can appropriate.

Although being theoretically robust, the current debate on the relation between property rights and RBV lacks an analytical framework which may serve as a basis for empirical investigations and focused business analysis. In face of this fact, and taking into consideration the background described above, the present article proposes a refinement of the examination of the relationship between property rights and strategy. This article is about how resources can best be conceptualized as bundles of attributes for which one can assign economic property rights (and not just legal rights). Strategic considerations are then incorporated into the analysis in order to design an approach to strategy. The next section further develops these ideas.

A property rights model of strategy

The theory of property rights provides an explanation of how firms can design organizational arrangements in order to exploit a given resource. As Barzel (2003: 43) notes: 'the development of

property rights theory has its roots both in questions related to the origin of property rights, and in the organizational forms asset owners use to exploit their assets'. This section investigates the basic elements of Barzel's theory of property rights and critically examines how strategic aspects may be explicitly incorporated into the analysis.

Basic elements

Barzel (1994, 2003, 2005 [1997]) develops a model of economic analysis of property rights. His main contributions are to introduce the concept of 'resource as a bundle of attributes' and to claim that a more efficient analysis may be obtained if one examines the ownership of attributes instead of the ownership of the resource itself (Foss and Foss, 2001). The analysis becomes more efficient because, according to Barzel (2005 [1997]), the majority of resources are composed of a multitude of attributes so that the notion of ownership of the resource is, at best, inaccurate.

Barzel's analysis is built on a tripod which represents the foundation of the economic analysis of property rights. The tripod consists of three basic components, namely: resource as a bundle of attributes, economic property rights and public domain.

Resource as a bundle of attributes. According to Barzel (2005 [1997]), a resource is composed of a multitude of attributes. An attribute corresponds to any specific feature or possible use of the resource.

From a historical perspective, the theme of the multiple attributes of a resource was earlier examined by Lancaster (1966), who states that consumers do not seek to acquire a good in itself but its characteristics, thus generating the neoclassical model of demand for attributes. Lancaster (1966) basically argues that the problem of multiple dimensions of a product can be overcome by assuming that all versions of the same product which vary in quality represent distinct goods.

From a strategic point of view, Lancaster's approach ignores transaction costs and thus does not confer any function for contractual arrangements. As noted by Eggertsson (1990), the discussion about the different attributes of a resource may emerge as a consequence of imperfect information, so that some resource attributes may not be accurately measured. As a result, the allocation of resources between different uses may be subject to coordination problems, and contractual arrangements may play a pivotal role.

Let us consider a simple example. Suppose a restaurant wants to buy weekly bundles of apples from a producer. The restaurant is going to prepare a series of selected dinners and seeks to acquire fruit with delineated attributes: good appearance and sweet flavor. If the measure of all the attributes of an apple was perfect, the transaction would occur immediately. However, since the ex-ante measurement of the apple's flavor might be too difficult or expensive, the firm may choose to establish a contract with the farmer, specifying some minimum parameters and possible punishments.

Following Eggertsson (1990), we assume in this article that resources have multiple dimensions and explicitly consider the effects that contractual arrangements may have on the allocation of attributes.

Economic property rights. Barzel (1994, 2005 [1997]) establishes a fundamental distinction between legal property rights and economic property rights. The first is what the state assigns to an agent. The second refers to the agent's ability, in expected terms, to consume the goods or services associated with a given resource.⁴

As noted by Barzel (1994), the keyword in the definition of economic property rights is 'ability'. The definition is concerned not with what the agents are legally entitled to do but with what they believe they can do. In this sense, legal rights are neither a necessary nor a sufficient condition for the existence of economic rights. Barzel (1994: 394) claims, for instance, that 'the title holder of a car is its legal owner, but thief has rights to it since he might drive it, derive income out of it, or even sell it'.

One should note that such description has interesting implications for strategic analysis. In Barzel's example, the thief has economic rights to the car because he or she is able to appropriate part of its value. The same reasoning applies to a company that is said to have sustainable competitive advantage. The competitive advantage is just sustainable if the firm has perfect economic rights to every potential use (attribute) of the resource. The case of GM soybean seeds discussed in the fourth section of this article is an illustration. Although a biotech company may have perfect legal rights to a GM attribute of a seed, the company may not have the perfect economic rights. The biotech characteristics of the plant make it easy to farmers to self-reproduce the soybean seeds, thus eroding the economic rent of the biotech firm.

Even so, consistent with Foss and Foss (2001), one may note that although the definition of economic property rights is logically disconnected from legal considerations, it is implied that the agent's ability to consume the services of a resource depends on his or her ability to exclude others from the consumption of the same resource. This ability, in turn, depends partly on the legal protection. As a result, the delineation of economic property rights is dynamic in nature, being a function of the protection granted by the state, of other agent's capture attempts and of the individual's own protection efforts (Barzel, 2005 [1997]).

In any case, expanding Foss and Foss's (2005) analysis, we may also refer to the designation of economic property rights to each attribute that encompasses a given resource. Formally:

PROPOSITION 1: Because a resource is composed of different attributes, economic property rights can be assigned for each attribute that encompasses the resource.

One might note that the assignment of economic rights for the attributes of a resource implies a broader concept than the assignment of legal rights. The economic ownership of an attribute is straightforwardly connected to the idea of value appropriation. The allocation of economic property rights is based on the relative position of each agent in relation to the appropriation of value. As said, a thief may have economic rights to a car, even if he or she does not have the legal rights to it; the thief is in a potential position to consume some of the services associated with the resource (car).

According to Kim and Mahoney (2006), the notion of resource as a bundle of property rights contributes to RBV by encouraging the view that certain resource partitions can be disaggregated and then recombined according to specific need. Equally important, the notion relaxes the RBV assumption that resources represent the irreducible unit of analysis. From the perspective of property rights, it becomes possible for firms to allocate bundles of economic rights over particular attributes for agents to create the highest economic value.⁵ In this case, transaction costs associated with research, distribution and re-aggregation of the bundles of rights may play a key role (Kim and Mahoney, 2006).

Additionally, Foss and Foss (2005) note that, from the perspective of property rights, firms have heterogeneous resources not only because they have different initial allocations of resources and subsequent learning effects, but also because they are subject to different regulations (i.e. constraints on use rights), and face different costs of protecting and utilizing resource attributes in production and exchange. Accordingly, when resources change in response to changes in economic property rights over specific attributes, the potential value created and appropriated by the firm

may also change – e.g. using a car in a more secure area is different from having a car in a violent region.

Public domain. According to Barzel (2005 [1997]), the notion of public domain relates to the idea of value dissipation. An attribute belongs to the public domain when the resources required for its acquisition are not directed at anyone.

Eggertsson (1990) provides more ground to Barzel's (2005 [1997]) definition by identifying three elements that guide the ownership structure of a resource towards the communal property and the open access; they are: (1) high costs of exclusion, (2) high costs of internal governance where rights are shared and (3) the establishment by the state of the rule of free access.

Dixit (2004) also emphasizes the cost of exclusion as the basis of the public domain; according to this author, an attribute is located in the public domain if its property is not specified or cannot be achieved. In general terms, we consider in the present article that the public domain is fundamentally characterized by difficulty of exclusion resulting in dissipation of value when agents try to acquire the attributes assigned in the public domain.

As a general principle, economic agents try to maximize the value of their economic rights over resource attributes through use in production or exchange. However, every maximization effort is potentially constrained because the mere existence of the public domain means that the economic ownership may be restricted to the extent that the cost of excluding others from the use of certain attributes of the resource is prohibitively high. In the case of oil field unitization, the possibility that an individual can extract oil in his or her territory and such oil may come from the property of another individual characterizes a situation where the economic property rights over crude oil is not well delineated. If excluding a neighbor of the consumption of crude oil from a specific site is too costly, value dissipation may occur and valuable attributes of crude oil may evade to the public domain. Similarly, valuable attributes of a car evade to the public domain if excluding an individual (thief) of the consumption of another person's car is too high.

When an attribute is placed in the public domain, it is subject to capture attempts. In this sense, the efficient pattern of ownership on the attributes of a resource is one that minimizes the possibility of capture, given the value of the attribute and the associated cost of protection. The important point is that such ownership pattern may itself corresponds to an organizational arrangement whose *raison d'être* is the restriction of the capture attempt. Accordingly, an organizational arrangement within the theory of property rights is one that seeks to mitigate the capture of imperfectly delineated economic property rights, or conversely, one that seeks to maximize the value of the economic rights.

Strategic dimensions

In light of the above description, the next step is to discuss how strategic aspects may be explicitly incorporated into the property rights framework. One intuitive way of introducing strategic elements in the analysis of property rights is by examining the capture and the protection of economic rights.

The capture of economic rights means the deliberate, resource-consuming activity of appropriating economic property rights from others without compensating them (Foss and Foss, 2005). In other words, capture means the attempt to control certain transaction-related attributes, where control is understood as the agent's freedom to handle an attribute without making side payments to other agents (Barzel, 2005 [1997]).

Capture attempts include, among others, activities of imitation, reverse engineering and holdup. Our previous discussion on the car thief is an obvious example. The case of GM soybean seeds is another illustration. Because soybean plants are characterized by the transmission of genetic traits between generations, the capture of economic property rights on biotech innovations in soybean seeds tends to be easy. Farmers capture economic rights through the reuse of a grain crop as seed for the next season or the purchase of seeds on the black market.

Generally speaking, a successful capture implies that the cost of capture is not prohibitively high and that at least some economic property right is not perfectly delineated, i.e. valuable attributes evade to the public domain.

Specifically, the imperfect delineation of economic rights can be associated to two basic situations. On the one hand, certain attributes of the resource may be in the public domain for reasons beyond the control of the manager. This is the case, for example, of the establishment of a state rule of free access to some valuable dimension of a resource. It is also the case of the existence of some intrinsic characteristic of the resource that facilitates the reproduction of valuable attributes.

On the other hand, an agent may explicitly act in order to raise the third parties' cost of protecting valuable attributes, thus enabling the capture. Accordingly, the activity of capture may involve the deliberate act of identifying and influencing the elements that cast valuable attributes to the public domain, so that the company is able to appropriate economic rights held by other agents. Going back to the example of the oil field, it can be the case that a producer implements some source of pumping equipment which does not bring any substantial production gain to him, but makes it more costly for his neighbor to extract oil.

The protection of economic property rights corresponds to any resource-consuming activity that aims to reduce the possibility of capturing economic rights (Foss and Foss, 2005). Protection efforts include the establishment of mechanisms that make it costly for others to imitate resources (Rumelt, 1984; Wernerfelt, 1984), the design of contracts and governance structures (Williamson, 1996), the establishment of implicit contracts and relational mechanisms (Klein and Leffler, 1981) and the use of the legal system. All these activities represent what was generally termed as an organizational arrangement, that because its primary function is to restrict the possibility of capture.

In general terms, an agent establishes protection efforts in order to raise his or her appropriated value,⁶ in the face of capture attempts undertaken by other players. However, because certain attributes of a resource may escape to the public domain or be subject to explicit capture by other players, the protection of property rights is hardly perfect.⁷ Furthermore, the severity of the capture problem may vary from case to case and it may not be uniform across different dimensions of the same resource. This particular aspect is described in proposition 2:

PROPOSITION 2: Different protection efforts may be associated with the same resource, depending on the attribute that one intends to protect.⁸

The above proposition emphasizes the microanalytical nature of the strategic analysis based on property rights. The analysis is focused on the valuable attributes of a resource, its dependent variable is the economic property rights over such attributes and its analytical principle involves identifying and influencing the elements that throw attributes into the public domain, giving shape to activities of value capture and value protection.

One may thus advance the proposition that the competitive advantage of a firm is mainly related to its organizational capacity of solving a tradeoff which involves three elements: (1) the allocation of resources to value creation, (2) the protection of the value created and (3) the attempt to capture the value generated by other firms.

The term ‘organizational capacity’ refers to the ability of the firm in anticipating the other players’ strategic decisions, which is related to some important degree to the company’s expectations about the strategic investments of the other players. When making a choice on the amount of resources allocated to protect (capture) economic rights, firms tend to estimate the other agents’ level of capture (protection) efforts. Such estimation, however, may be inherently bounded once agents are intentionally rational, but only to a limit (Simon, 1961). More importantly, there is no guarantee that a specific competitive strategy designed by the company is successful. The appropriation of value within the property rights perspective is a function of the capture made by and against the firm, and its protection efforts.⁹

Additionally, one should note that protection efforts and capture attempts do not exist in a vacuum. They can be strongly influenced by the institutional environment within which the attribute is used. For North (1990), the institutional environment concerns the system of rules – informal and formal constraints – that affect the process of transferring property rights. Informal rules are implicit constraints within a particular culture which can be derived from customs or codes of conduct. Formal constraints are compulsory rules made explicit by some legitimate power with the purpose of maintaining order and development of a society.

In general, the existence of a legal apparatus is important because it establishes the rules to be followed by firms. Such rules interfere with the way transactions are carried out because they create incentives or transaction costs for organizations. In accordance with transaction costs economics (Williamson, 1991, 1996), it follows that:

PROPOSITION 3: The protection and capture of economic property rights are embedded in the institutional environment which corresponds to a shifter parameter on the strategic equilibrium.

As a corollary one may state that within a strong institutional environment, the guarantee of legal and economic rights occurs almost immediately, reducing the relative efficacy of capture. Conversely, the lower the enforcement provided by the institutional environment, the lower the security of legal and economic property rights on the attributes of resources and therefore the greater the capture problems. In this case, strategic actions designed by firms become naturally more complex, demanding private protection efforts that may encompass a number of organizational and strategic alternatives.¹⁰

It bears emphasizing that the examination of the institutional environment is not new in the strategy literature. According to the institution-based view of strategy (Monteiro and Pianna, 2012; Peng, 2002; Peng and Khoury, 2008; Peng et al., 2008, 2009), the strategic analysis of institutions combines with the two dominant perspectives in the strategy literature to form a ‘strategy tripod’. These dominant perspectives encompass the so-called industry-based view (Porter, 1980) and resource-based view (Barney, 1991).

From a different perspective, Oxley (1999) analyzes the influence of the institutional environment on the organizational choice of international inter-firm alliances. Henisz and Williamson (1999) formalized this same concept when examining the governance of economic activity under distinct institutional regimes.

Conclusion

This section explores how a property rights perspective can be used to generate insights with respect to business strategy. In particular, the theoretical model discussed above is built on three fundamental concepts (resource as a bundle of attributes, economic property rights and public domain). The model also relies on two definitions (capture and protection). These basic elements

combine in order to produce an approach to strategy which may help clarify the current understanding on competitive strategy.

In developing the model, the authors were able to identify some key issues for structuring the strategy formulation process of the firm. Regarding a property rights perspective on strategy, managers should keep in mind four basic questions (Figure 1):

1. *What are the valuable attributes of the organizational resources?* The answer to this question may not be simple. This involves an ongoing review process of the firm's portfolio of resources and, most importantly, an investigation of the dimensions of these resources that really add value to the firm.
2. *Which elements influence the firm's ability in appropriating the created value?* Managers must be able to identify, through studies of market intelligence, the aspects that can potentially put at risk the appropriation of value. Considering the limited rationality of agents, this identification process should involve, to some degree, an organizational routine that makes this analysis minimally structured.
3. *What are the protection strategies that may be associated with each valuable attribute?* Given the possibility of value capture, managers should structure protection mechanisms of economic rights. Such mechanisms should be not only effective to minimize the possibility of value capture, but also cost effective. Accordingly, protection efforts encompass a detailed examination of the possibilities available for protection and its effects on the financial position of the firm.
4. *How can the institutional environment influence the relative efficacy of capture in relation to protection of economic rights?* Managers should be aware of the influence that the institutional environment can have on the relative efficacy of value capture. A reduction on the state enforcement capacity, for instance, can make the capture problem more severe, requiring a repositioning of the protection strategy.

In what follows we apply this analytical framework to a particular case: the collection of royalties on the genetically modified (GM) technology in soybean seeds. The case contrasts to the traditional resource-based analysis on two fundamental aspects. First, the strategic analysis relates to one attribute of a resource. The strategic actions are focused on a specific attribute (genetic trait) of a particular resource (seed) and not in the resource itself. Second, the institutional environment plays a key role on the design of the firms' protection strategy.

Illustration: The collection of royalties on GM soybean seeds

The development of biogenetics has introduced a new competitive paradigm in the seed sector. Any seed may be interpreted as a technology vector composed of different characteristics, the genetically modified (GM) seed being a specific case where one or more seed attributes are not normally attainable by the species under natural conditions. Since genetic traits may result from R&D efforts made by different firms, the seed plays the role of a complex resource.

One of the most disseminated GM seeds corresponds to the soybean seed that presents tolerance to the herbicide Roundup®, whose active ingredient is glyphosate.¹¹ Value is added with the adoption of GM soybean seeds based on the reduction in production costs, which is mainly related to the lower consumption of agrochemicals. On the other hand, the use of GM seeds involves the payment of royalties to the company that holds the legal property rights on the technology.

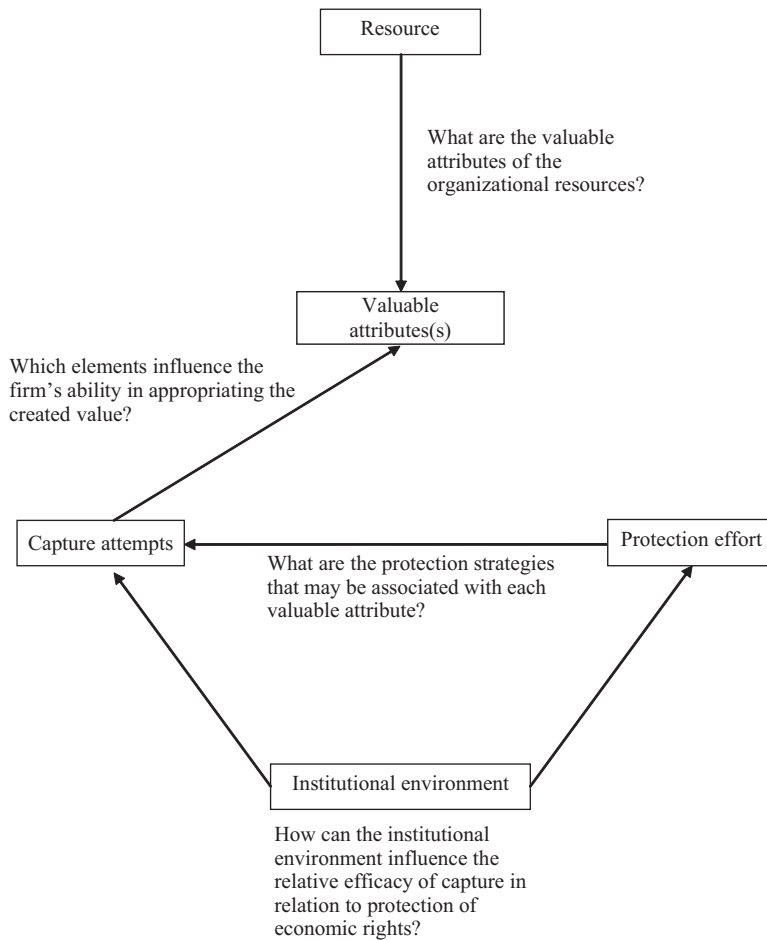


Figure 1. Property rights model of strategy: key questions

Even though royalties represent the return associated with the innovation, it is quite common for innovators to lament the fact that imitators have profited more from the innovation than the firm first to commercialize it (Teece, 1986). In the case of soybeans, the possibility of transmission of genetic traits between generations (i.e. self-reproducibility¹²) makes this issue even more emblematic because farmers can reuse a soybean grain as seed for the next season. As the soybean seed contains the genetic innovation, the self-reproducibility makes the cost of capture of property rights on biotechnology innovations greatly reduced. Farmers capture economic rights through the reuse of a grain crop as seed for the next season or the purchase of brown-bagged seeds.¹³

The possibility of capture reduces the ability of the firm in appropriating the value created by the biotechnological innovation. As a result, biotech firms have to establish protection efforts. Companies struggle to maximize their economic property rights subject to both the severity of the capture problem and the institutional constraints. In order to examine these aspects we briefly analyze three cases of protection of property rights on GM soybean seeds: the US, Brazil and Argentina.

Comparative analysis

Since the 1980s, the granting of utility patents for firms in the US biotechnology sector has been possible. A GM seed has three basic components capable of patent protection: (1) the plant germ-plasm (i.e. the plant itself as an expression of a specific genetic structure), (2) the sequences of genes or genetic traits that result in a specific, external change in a given organism and (3) the research tools necessary for incorporating the new genetic trait in the plant cell. Currently, a single seed produced in the US can tie up a number of patents each of which protects a specific seed attribute.

The granting of a patent on a genetic trait, however, is only the first step in the effort to protect economic property rights on soybean seed production. As noted, soybean is characterized by self-reproducibility, and so user's cost of capturing property rights of technology innovations is small. Farmers capture rights by reusing the grain crop as seed for the next season or by purchasing brown-bagged seeds. In the face of this problem, the US biotech firms structure their protection efforts around two elements: the establishment of technology agreements and the use of the legal system.

Technology agreements are used by most biotech firms.¹⁴ In general, each purchasing of GM soybean seed is under a contract that basically limits the use of the seed to a single crop and restricts the saving of the harvest for future planting. In most agreements the companies spell out the record numbers of their patents and the laws that ensure their protection. The agreement provides a limited using license which means that the firm allows the use of the gene by the farmer, but does not hand over its property to him or her.

In general terms, if technology conditions are such that the cost of capture of property rights is sufficiently high, a technology agreement – supported by an active, stable judicial system – is expected to reduce firms' protection costs. Given the high cost of capture and the effectiveness of the judiciary, capture attempts occur less frequently and thus less protection effort is required. Nonetheless, since the cost of capture of property rights on GM innovations in soybeans is small, biotech companies must use more complex schemes of monitoring and enforcing technology agreements.

As an example, Monsanto created a department composed of 75 officials that consumes US\$10 million annually and whose sole purpose is to ensure the protection of property rights (Enders and Goldsmith, 2007). This is interesting because it reveals that the recourse to the legal system neither represents a set of fuzzy legal claims, nor takes the form of an omnipresent threat that, by itself, automatically reduces the intensity of the capture attempts. The protection of property rights requires a specialized organizational structure. In the case of Monsanto, the operation of such organizational structure has resulted in the filing of 112 legal claims involving 372 farmers and 49 small associations, from 1997 to 2007 (CFS, 2007).

In contrast to the US case, the Brazilian institutional environment regarding the commercialization of GM seeds was unstable between 1995 and 2005. During this period the production and commercialization of GM seeds were prohibited in the country. Despite the ban on planting GM seeds, farmers – especially in the southern region of Brazil – have illegally adopted the GM technology through the smuggling of Argentinean soybean seeds from 2003 to 2005.¹⁵

The prohibition in domestic marketing of GM seeds along with the illegal import of seeds from Argentina restricted the property rights protection strategies available to biotech firms. There was no basis for proposition of legal action for recovery of royalties since the presence of GM seeds in the domestic market was legally prohibited. This lack of basis for royalty collection, however, did not last for long.

In 2004 the Brazilian market was flooded with GM grains whose existence in the national market was not authorized. In the face of this problem, and considering the large soybean production, the Brazilian government decided to implement a series of legal measures that allowed ex-post the planting of GM seeds. More importantly, if adoption of GM seeds is legally permitted and farmers effectively adopt it, then firms may establish mechanisms for recovery of royalties (Zylbersztajn et al., 2007).

In the case of Monsanto, the first company to commercialize GM seeds in Brazil, the collection of royalties had to cope with two issues. On the one hand, it had to be retroactive because farmers had already harvested the GM soybeans. On the other hand, it would be based on seeds purchased on the black market.

The strategic solution involved the design of a contractual arrangement according to which the farmer had the freedom to state what type of technology had been used on his property. If the farmer declared that he had used GM seeds, a charge was laid and its value was reduced from the payment made to him by the cooperative, the processor, or the trading company. If the farmer did not declare the adoption of the GM technology, a field test was conducted on each shipment delivered by him. If the test was positive for the presence of GM seeds, the farmer had to pay a fine and bear the cost of the test. Given the widespread adoption of GM seeds and the risk of penalty, 98% of farmers in the southern region of Brazil agreed to the contract (Zylbersztajn et al., 2007).¹⁶

The analysis of royalty collection in Brazil reveals a fundamental aspect. The property rights protection strategy undertaken by the firm is based on the unbundling of the attribute (tolerance to glyphosate) from the resource (seed), outlining a particular way to negotiate the attribute regardless of how the acquisition of the resource was made. This is relevant since the collection of royalties is based on seeds purchased on the black market.

In the case of Argentina, the fundamental aspect of the regulatory framework of production and commercialization of GM seeds is the recurring changes in the institutional structure. As described by Kesan and Gallo (2007), more than four federal agencies focused on the regulation of property rights on plants were created since the 1990s. Moreover, between 2000 and 2004, due to a severe economic crisis, government oversight over property rights on plants was interrupted. Regarding our discussion in the earlier section, such unstable dynamics hinder the establishment of firms' efforts to protect economic rights.

In addition to the institutional instability, companies operating in Argentina cannot claim patent protection for new varieties of plants or genetically modified organisms. Between 1864 and 1995, the patent system in Argentina was regulated by Law 111. Although this law did not contain a specific provision on plants, there were no patent applications for new plant varieties during this period (Kesan and Gallo, 2007). In 1995 the patenting of plants was formally prohibited (Law No. 24,481 and No. 24,572). In opposition, a law approved in 2000 provided for the patenting of 'biotechnical products and organisms' (Law No. 24,575). As noted by Kesan and Gallo (2007), apparently the law passed in 2000 could serve as a basis for the protection of GM varieties of plants, but the prohibitions introduced in 1995 generated legal uncertainty about the ability of a firm to effectively obtain a legal protection.

Generally speaking, the weakness of the institutional environment – both in terms of the institutional instability and the absence of an effective patent system – implies that the relative efficacy of capture of property rights on biotechnological innovations in Argentina tends to be high, requiring private protection efforts and, at the margin, leading to the abandonment of valuable attributes in the public domain. The most notorious case of abandonment of attributes refers to the finishing of the commercial activities of Monsanto Soybean in Argentina in 2004.

Although the Monsanto case can be especially representative, it should be noted that the abandonment of valuable attributes does not necessarily involve a sharp break of a company's

Table 1. Property rights analysis of royalty collection on GM soybean seeds

(i) What is the valuable attribute of the organizational resource?	GM attributes			
(ii) Which elements influence the firm's ability in appropriating the created value?	Self-reproducibility of soybean seeds			
(iii) What are the protection strategies that may be associated with the valuable attribute?	(iv) How can the institutional environment influence the relative efficacy of capture in relation to protection of economic rights?			Protection mechanism
	Country	Patent protection?	Institutional environment?	
	U.S.	Yes	Strong	Strategy centered on the legal system
	Brazil	Yes	Weak	Contractual arrangement
	Argentina	No	Weak	Abandonment of valuable attributes; pump-priming pricing strategy

operations in a specific market. Analyzing US biotech companies operating in Argentina, Enders and Goldsmith (2007) argue that firms can achieve profitability even in a weak institutional environment provided that they adopt non-monopolistic pricing strategies. According to the authors, if the probability of punishment is sufficiently low and farmers seek to maximize their intertemporal utility, farmers may be willing to pay a high price for GM seed in the first planting season.

Under these conditions, the biotech company knows that its monopoly power is sustainable only in the first period and that saved seeds tend to establish a ceiling price as soon as the second period begins (pump-priming pricing strategy). The ceiling price, in turn, varies according to the costs of storage of seeds between planting seasons and the dynamics of the black market.

In sum, the description above reveals that economic rights over genetic innovations in soybean seeds are subject to capture because the biological characteristics of the seed place such innovations in the public domain, creating the possibility of value capture. As a result, firms undertake protection efforts by means of developing organizational arrangements in order to minimize the capture of value. The previous description suggests that such organizational arrangements are dependent on the institutional environment in which the purchasing of the seed occurs.

Table 1 summarizes the analysis, highlighting the key questions of the property rights approach.

Concluding remarks

The present article places the theory of property rights (Barzel, 1994, 2005 [1997]) within a broader perspective, claiming that property rights logic can generate insights in the study of strategy which cannot be generated from received strategic approaches.

Specifically, the authors propose that the strategic formulation process of a firm is focused on the valuable attributes of its resources, the dependent variable is the economic property rights over

such attributes and the analytical principle involves identifying and influencing the elements that throw attributes into the public domain, giving shape to activities of capture and protection.

Following Foss and Foss (2005), the capture of economic property rights is defined as an intentional, resource-consuming activity of appropriating economic rights from others without compensating them. Protection, on the other hand, is a resource-consuming activity that aims to reduce the possibility of capturing economic rights. These two definitions are important because they highlight that property rights logic may serve as the basis of any strategic action undertaken by the firm.

One should note, however, that the capture and the protection of economic rights do not exist in a vacuum; they are embedded in the institutional environment. As a general principle, the lower the enforcement provided by the institutional environment, the lower the security of economic rights on the attributes of resources, and the more sophisticated the protection efforts. The article introduces three propositions as well as a list of four questions to guide how property rights might influence strategy.

When applying the above framework to a particular case (the collection of royalties on GM soybean seeds), the analysis contrasts to established resource-based analysis in two aspects: (1) strategic actions relate to one attribute of a resource; (2) the institutional environment plays a key role in the design of the protection strategy.

Although soybean seeds represent a good example of complex assets composed of different attributes, the theoretical framework introduced in this article is especially general in its form. This study represents only a first attempt in the search for a more general model of strategy based on property rights insights.

Acknowledgements

The authors appreciate the comments of Sylvia Saes, Silvia Caleman, Bruno Varella, as well as three anonymous referrers. All errors and omissions remain our responsibility.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Notes

1. Under oil field unitization, drilling is delegated to a single operator, so that instead of trying to maximize the economic value of an individual lease, the economic value of the unit is maximized (Kim and Mahoney, 2007; Libecap, 1998).
2. According to the Coase theorem, the initial partition of property rights does not influence the allocation of resources when all rights are freely transferable and transaction costs are null. However, when transaction costs are positive, the role of the state can have a crucial effect on the allocation of resources (Eggertsson, 1990).
3. Alchian (1965) also examines this notion when stating that property rights on a resource are usually partitioned.
4. The term 'consume' originally used by Barzel (1994, 2005 [1997]) is not interpreted narrowly. The term is interpreted as 'to appropriate value'.
5. Kim and Mahoney (2006: 46) note that: 'Understanding resources as bundles of property rights not only makes it possible to better define these resources, but is also consistent with Penrose's (1959) initial theoretical insight that it is not the resources themselves but how the services of these resources are utilized that is critical for understanding resources as a source of competitive advantage' (Kor and Mahoney, 2000, 2004; Tan and Mahoney, 2005).

6. The term 'appropriated value' is equivalent to 'realized value' as proposed by Kim and Mahoney (2002).
7. A protection is said to be perfect when no attribute is in the public domain. In such situation, any capture attempt may fail, considering that the owner has perfect control over his or her economic property rights.
8. As an example, one may consider the case of a car. To prevent a thief from stealing the car, the owner can install a lock or alarm. To protect the car paint from scratches caused by other drivers, the owner can purchase a protective film. To preserve the power of the engine from adulterated fuels, the owner can consume only premium gasoline. And so on.
9. This is equivalent to the idea that economic property rights are dynamic in nature.
10. For instance, the establishment of mechanisms that make it costly the imitation of resource attributes; the design of complex governance structures; and the establishment of implicit contracts and relational mechanisms.
11. Roundup seeds are market by Monsanto.
12. Seeds characterized by self-reproducibility are called non-hybrid seeds. On the other hand, hybrid seeds are those in which transfer of genetic traits to future generations does not occur or occurs only in a limited way. The cases where firms are able to undertake technological changes that affect the self-reproduction of seeds are disregarded – for example, the introduction of a gene (gen terminator) preventing the self-reproduction of soybean seeds. This type of technology is characterized by intense controversy and it has not yet been adopted.
13. Brown-bagged seed is that purchased on the black market.
14. Maxwell et al. (2004) present a summary of the main features of the technology agreements used by leading companies in the agrobiotechnology field.
15. The marketing of GM soybean seeds was introduced in Argentina in 1996.
16. Currently, the royalty payment is set at 2% on the value of total production. The fine was set at R\$150.00 per ton (season 2004/2005) equivalent to approximately US\$53.40 per ton.

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Author biographies

Guilherme Fowler de Avila Monteiro is a Professor of Institutional Economics and Business Strategy at Insper Institute of Education and Research (Brazil), and an Associated Researcher at the Center for Organization Studies at the University of Sao Paulo (USP). He received his PhD in Business Economics from the University of Sao Paulo, and during his doctoral studies he was a fellow at the European School on New Institutional Economics and the Ronald Coase Institute. His research has been published in journals such as *International Journal of Strategic Change Management* and *Development Policy Review*. Address: Insper Institute of Education and Research, 300 Quatá St., Vila Olímpia, Sao Paulo, SP, Brazil – Zip 04546-042. [email: guilhermefam@insper.edu.br]

Décio Zylbersztajn is a Full Professor of Economics of Organizations at the School of Economics, Business and Accounting at the University of Sao Paulo (FEA/USP). He is also a member of the Advisory Board of the Agribusiness Intelligence Center of the University of Sao Paulo (PENSA). He received his PhD in Economics from North Carolina State University and he was a Post-Doc Visiting Researcher at the University of California – Berkeley. His research has been published in numerous journals, such as *Agricultural Economics*, *Journal of Economic Behavior and Organization* and *International Journal of Chain and Network Science*. Address: School of Economics, Business and Accounting, University of Sao Paulo – FEA/USP, 908 Luciano Gualberto Av., Cidade Universitária, Sao Paulo, SP, Brazil – 05508-900. [email: dezylber@usp.br]