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# On Modeling Resource-Strategy-Performance Linkages

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# On Modeling Resource-Strategy-Performance Linkages


## ABSTRACT

We develop a parsimonious model to analyze the dynamic adjustment between resource, strategy, and performance (R-S-P). We also provide insights gained from analyzing prototypical contexts. The roots of the R-S-P model are predominantly in resource-based theory, the empirical findings of dynamic strategic groups literature, reference point theory, and learning theory. Our results show the emergence of complex behaviors of strategy changes, industry structure and performance variations from simple rules. We explain performance variations over time not as outcomes of random processes or irrational acts on the part of managers, but as emerging from industry dynamics based on strategy adjustments to achieve improved performance. Our modeling efforts form the base for more textured empirical and more general computational research to be carried out in the future.



**Key words:** Strategy Dynamics, Resources, Strategic Change, Performance.


## INTRODUCTION

Strategic management is fundamentally concerned with environmental changes and organizational adaptations (Ansoff, 1979; Hofer and Schendel, 1978). However, modeling the dynamic of strategy and competitive advantage stays a persistent challenge in the field of strategic management. In 1991, Porter recognized that "[w]e are left still short of a dynamic theory of strategy, though we are beginning to learn about the subprocesses involved." (p. 109). This shortfall is still present today, ten years later. "Without a dynamic theory each episode of strategic decision making must be treated as a an independent event. Yet over time organizations re-formulate strategy from an existing set of commitments and constraints in response to past and predicted future performance." (Huff, Huff and Thomas, 1994) There is still a gap in our understanding the dynamics of strategic change, especially when the matching of firm-level distinctive competences and industry-level sources of competitive advantage is concerned (Burgelman, 1994; Mehra, 1996).

Our contribution in this paper is to propose a Resource-Strategy-Performance (or R-S-P) model to explain and predict a firm's likely direction and magnitude of change in its strategy. In the

proposed model, strategy change is influenced by a firm's motivation to change and it's capability to change and the direction of change is determined by the strategy position of a referent. Performance is modeled as a function of the distance to the position of the referent and the density of competitor around this referent. Firms have the choice of their referent. However, if they choose to follow a referent with a very different resource endowment, strategy change is likely to lead to a drop in performance. The results of our analysis show in which situations strategy changes are likely to lead to a firm's performance improvement or decline. They also provide a deeper understanding of changes in leadership observed in many industries. At the industry level, they also indicate the situations in which strategic convergence and fragmentation are likely to occur.

The remainder of this paper is organized as follow: We first present a review of the relevant literature, including the resource-based theory of competitive advantage, strategic group theory, reference point theory, and learning theory, which represent the four pillars of our model. Second, we describe our theory development and explain our model. Third, after presenting the methodology we graphically show and discuss the analytical results of the model dynamics. Fourth, we discuss the issues open by the results of our model, and finally we conclude with a proposed agenda for further research.

## LITERATURE REVIEW

Our paper has its roots predominantly in resource-based theory, the empirical findings of dynamic strategic groups literature, reference point theory, and learning theory. We first briefly review these literature streams before presenting the model. We have structured the review of the literature in the following way: We first present the resource-based theory to show the dynamic relationship between a firm's resource position and its performance. We turn then our focus to strategic group theory and in particular to the stream that looks at the positions of firms in strategy space over time. We show that these strategic groups studies only explain a strategic move *ex post* and have difficulty in predicting moves from one group to the other, i.e. in predicting moves in strategy space. Third, we present reference-point theory, whose objective is to predict the direction of a strategic move. Reference-point theory postulates that a firm is likely to make its strategic change in the direction of a reference point. However, reference-point

theory does not explain which firms are more likely to move and how far these firms will move towards their reference point. Learning theory addresses this question. It explains how feedback from past performance may explain the likelihood of strategic change as well as the magnitude of change. We conclude our review of the literature with the presentation of the few recent studies that have looked at the relationships between resource, strategy, and performance. While these studies are static, they lead us to the integration of the building blocks needed to build our dynamic model.

**Resource-Based Theory**

The focus of the resource-based theory is on the relationship between firm resources and firm performance. One of the key arguments of the resource-based theory is that potential sustainable superior performance can only be achieved when resources are valuable, rare, costly to imitate, and have no substitutes (e.g., Barney, 1991; Mahoney and Pandian, 1992; Peteraf, 1993). A firm's resource position is not static. It can be changed to its detriment through erosion or neglect (Collis, 1994). It can also be enhanced through investment (Day and Wensley, 1988). The capabilities that a firm has to maintain a superior resource position are called metacapabilities by Collis (1994) and dynamic capabilities by Teece, Pisano and Shuen (1997). The concept of metacapabilities provides the explanation needed to address a problem noticed by Teece, Pisano and Shuen (1997) in resource-based theory. As noticed by Teece, Pisano and Shuen (1997) the resource-based theory does not perform well with respect to assisting in the understanding of how and why certain firms enhance or maintain superior resource positions in regimes of change.

**Strategic Group Theory**

Using the lens of industry analysis, strategic group theory argues that a firm's performance is the result of its position in strategy space. Based on the concept of mobility barriers (Caves and Porter, 1977; Porter, 1980; Mascarenhas and Aaker, 1989, Sudharshan, Thomas and Fiegenbaum, 1991), strategic group theory argues that strategic group membership is a significant predictor of business performances, since different groups are protected by the existence of mobility barriers that inhibit movement from one group to another. Indeed, Caves and Porter's (1977) concept of mobility barriers was originally developed to provide a construct

for studying a firm's strategic movements within an industry. Empirical research on strategic groups has sometimes found considerable movement among strategic groups (e.g., Cool and Schendel, 1987, Sudharshan, Thomas and Fiegenbaum, 1991). Some of these studies, based on longitudinal data, have tried to explain, albeit *post hoc,* why the changes that were observed were observed (e.g., Porac, Thomas and Baden-Fuller, 1989; Porac et al., 1995; Bogner, Thomas and McGee, 1996). However a *post hoc* explanation is not sufficient to develop a dynamic theory of strategy. There is a need to better annunciate an *ex ante* rationale for strategy changes.

**Reference-Point Theory**

Reference-point theory (Fiegenbaum and Thomas, 1995; Fiegenbaum, Hart and Schendel, 1996) suggests that firms would identify reference points and adjust their strategy toward these reference positions. Institutional theorists have also suggested that the uncertain consequences of adopting poorly understood organizational technologies lead organizations to model themselves on other organizations, causing mimetic adoption of practices (DiMaggio and Powell, 1983). Size, industry, and performance are important organizational characteristics that seem to affect reference group composition (Haveman, 1993; Davis and Greve, 1997), and within an industry similarity judgment may also be based on product, market, or production methods of the firms (Reger and Huff, 1993; Porac et al., 1995). Theories of how social structure influences opinions and actions usually assume that the basis for influence is the social comparison among actors who consider themselves similar on some dimension (Marsden and Friedkin, 1993). However, a perfect imitation of the strategy of the referent is difficult, or even impossible. Rivkin (2000) proposes that: "the sheer complexity of a strategy can raise a barrier to imitation." Therefore, perfect imitation is highly unlikely.

**Learning Theory**

Learning theory describes organizations as experiential learning systems that are "…routine-based, history-dependent, and target-oriented." (Levitt and March, 1988, p. 319) A central assumption in learning theory is that organizations learn from their experience by making the probability of change conditional on their history (Cyert and March, 1963). This has led to an interest in how the performance of the organization determines the likelihood of different types of strategy changes (Miller and Chen, 1994; Ocasio, 1994). Greve (1998) examines how

performance feedback affect the probably of risky changes. He postulates and finds that low performers are more likely to move and move more than high performers.

**Resource-Strategy-Performance Linkages**

The matching of firm-level distinctive competences and industry-level sources of competitive advantage, even if potentially very fruitful (Mehra, 1996), still remain underdeveloped in strategic management literature (Burgelman, 1994). Only few early studies have investigated the linkages between resource, strategy, and performance. For example, Snow and Hrebiniak (1980) showed that Defenders and Prospectors have identifiable but different configurations of distinctive competence, while Analyzers' special capabilities are considerably less apparent. Reactors, as expected, have no consistent pattern of distinctive competence. Lawless, Bergh, and Wilsted (1989) found significant differences in performance and capabilities within each of the strategic group they identified. They also found evidence of a significant correlation between capabilities and performance within each group. They concluded that effects of firms' capabilities should be accounted for to increase the explanatory power of strategic group in competitive performance. Recent empirical studies have started to investigate the relationships between resource, strategy and performance (R-S-P) in more details. Furrer, Sudharshan, Alexandre and Thomas (2000) empirically showed that interfirm performance differences may be explained by the distance of each firm to an optimal strategy position corresponding to its resource group (a group of firms with similar resource positions). Delios and Beamish (2001) studied the moderating effect of entry into a foreign country strategy on the influences a firm's intangible assets and its experience have on foreign subsidiary survival and profitability. Kor and Mahoney (2001) investigated the moderating effect of firm-specific experience of top managers and governance effectiveness on the profitability of resource deployment strategies. These studies, however, are all cross-sectional and do not explain how firms adjust their resources and strategy over time to improve their performance. To the best of our knowledge, the only exceptions are the research by Zajac, Kraatz, and Bresser (2000) and Kraatz and Zajac (2001) that use longitudinal designs to study the moderating effect of resource endowment on the relation between strategic change and performance. They found that firms possessing greater stocks of valuable resources were much less likely to engage in adaptive strategic change. Their finding is similar to Greve's (1998) learning theory-based work. They also found that this

resource-driven disinclination towards change tended to have a benign or even beneficial effect on performance as both too much and too little change are detrimental. So, change should be implemented based on the R-S-P relationship.

## THEORY DEVELOPMENT

Our model is based on the following findings from the literature reviewed above : (1) performance is better explained by the right combination of resources and strategy (Furrer, Sudharshan, Alexandre and Thomas, 2000; Delios and Beamish, 2001; Kor and Mahoney, 2001; Zajac, Kraatz, and Bresser, 2000; Kraatz and Zajac, 2001; (2) the motivation for change in strategy is a firm's relative performance (Greve, 1998); (3) change in strategy space is made in the direction of a referent (Fiegenbaum and Thomas, 1988; Fiegenbaum, Hart and Schendel, 1996), i.e., imitatively (Greve, 1998; Rivkin, 2000); (4) the extent of strategic change is constrained and dependent on a firm's resource position (Teece, Pisano and Shuen, 1997), and on its motivation (Greve, 1998); and (5) resources change is based on metacapabilities (Collis, 1994; Teece, Pisano and Shuen, 1997) and performance (Day and Wensley, 1988).

The theory development section follows the structure: (1) spaces of interaction–i.e., resource and strategy spaces; (2) model of performance; (3) concepts of reference point and imperfect imitation; (4) model of strategy change; (5) model of change in resource positions; and (6) model of impact of industry context.

### Space of Interaction (Strategy and Resource Spaces)

In our model, competitive firms are postulated as being positioned in two distinct multi-dimensional spaces, a strategy space, and a resource space. The strategy space is one in which firms are identified on the basis of their strategy and the resource space one in which the same firms are identified on the basis of their resources. McGee and Thomas (1986) and Thomas and Venkatraman (1988) noticed that a variety of dimensions might be used to define the strategy space. While early studies have used strategy variables to conceptualize strategic groups, recent studies (Bogner and Thomas, 1994; Mehra, 1994, 1996; Bogner, Thomas and McGee, 1996), on the other hand, have grouped firms based on their resource positions.

Strategic group theory argues that in an industry there exist one or more positions in strategy space that lead to superior performance (Porter, 1980, 1985). The position and the number of these optimal positions depend on industry economics and may change over time. To improve their performance, firms need to either identify the optimal position that matches their resource endowment or to develop or acquire the resources they need to reach their desired optimal position. Then, their performance allows them to update their resources to build mobility barriers to protect their positions against imitation in order to maintain their superior performance (Rumelt, 1984).

The resource-based theory views firms as bundles of resources and of those resources the ones which are valuable, rare, costly to imitate, and without substitutes have the potential to generate superior performance (Barney, 1991; Mahoney and Pandian, 1992; Peteraf, 1993). This implies that the dimensions of the resource space must be linked to performance (i.e., valuable and rare), a change in them must require an expenditure that is a function of performance (i.e., costly to imitate), and they must be orthogonal to each other (i.e., not substitutes). The position of several firms may be mapped in the same resource space.

**Performance and Position**

Deephouse (1999) observed that firms face pressures to be different and to be the same. By differentiating, firms reduce competition. By conforming, firms demonstrate their legitimacy. Both reduced competition and legitimacy improve performance. We model firm performance as a function of the distance to an optimum (based on legitimacy or fit theory and valuable property from resource-based theory) and of density around this optimum (based on the impact on performance of differentiation and rarity or uniqueness from resource-based theory). The performance of a firm with a given position in resource space will be a function of the distance between its actual strategy and an optimal strategy for firm with a similar resource position. This firm's performance will also be a function of the density of firms around the optimum. If there are many firms close to the optimum, distinctiveness will be low and therefore competitive advantage will also be small.

To improve its performance, a firm will modify its strategy to move closer to the optimum. A challenge is, however, that the optimum is unknown or unobservable (Rivkin, 2000). In such a situation, firms will, therefore, identify a referent (i.e., a firm or group of firms with a better performance) and modify their strategy toward this referent (Fiegenbaum and Thomas, 1995; Fiegenbaum, Hart and Schendel, 1996).

**Adaptation toward a Referent**

To understand how managers can achieve the dynamic fit required to improve performance or to gain a sustainable competitive advantage, cognitive strategic group theory (Reger and Huff, 1993; Porac et al., 1995) and reference-point theory (Fiegenbaum and Thomas, 1995; Fiegenbaum, Hart and Schendel, 1996) suggests that managers use referents to evaluate the relative strategic position and the direction to move to improve performance. Observing competitors provides firms with an opportunity to see how similar types of firms, often endowed with comparable resources, go about addressing opportunities and problems that are like the ones that they face (Peteraf and Shanley, 1997). Different types of firms, with similar resources, with similar strategy in the same industry, may be used as referent. In situations where several potential referents exist, firms may mistakenly (e.g., by using a mental model that does not reflect the industry well enough) choose to follow the wrong leader (i.e., a leader positioned far from the firm's "true" optimum). Following the wrong leader results in insufficient/excessive strategic change (Zajac, Kraatz, and Bresser, 2000). To be able to identify and follow the right leader may be considered as an "organizational alignment skill" in the words of Powell (1992). Depending on the initial condition (i.e., firms' dispersion in resource and strategy spaces) and the referents chosen we may observe a convergence around the optimum (no strategic groups) or divergence and the formation of strategic groups (Stuart and Podolny, 1996; Furrer, Sudharshan, Alexandre and Thomas, 2000).

**Strategy and Resource Changes**

Based on observed industry experience and its reference point, a firm adjusts its strategy. Each adjustment requires a choice of both direction of change as well as the magnitude of change. Strategy change is governed by a desire to improve performance under resource constraints and can be seen as an outcome jointly determined by motivation to change, opportunity to change,

and capability to change (Greve, 1998; Miller and Chen, 1994). In the pursuit of dynamic fit, strategy change is not a discrete or a unidirectional choice, it is likely to be of varying magnitudes and in different directions at different times (Burgelman, 1994; Zajac, Kraatz, and Bresser, 2000). Managers are assumed to be organizationally rational, in that they select and implement strategies that they think will lead to higher performance (Simon, 1976). As already mentioned, the direction of strategy change is toward a referent. On the other hand, the magnitude of strategy change is a function of the distance to the referent, the motivation to change (i.e., past and relative performance–Greve, 1998), and resource constraints (Day and Wensley, 1988; Peteraf, 1993). Many of the enablers and constraints of changes in strategy arise from meta or dynamic capabilities (Collis, 1994; Teece, Pisano and Shuen, 1997) and core rigidities (Leonard-Barton, 1992). To be able to modify its strategy, a firm needs to reconfigure its resource structure (Teece, Pisano, and Shuen, 1997) and it also needs to develop or acquire new resources (Makadok, 2001). It is known in the literature that resources are also vulnerable to threats of erosion and substitution (Collis, 1994) and therefore a firm needs to continually reinvest in its resource stocks. This reinvestment is possible as a result of a firm's decision to reinvest part of its financial performance in resources. The extent of resource change that is possible is dependent on the firm's metacapabilities. Some resources may be changed directly as a result of firm performance. For example, brand equity as a resource may be automatically updated if a firm's strategy leads to more loyal customers who buy more.

In summary, a firm will move towards its referent in strategy space if it perceives that its relative performance may be improved by strategic change. A performance leader is unlikely to change its strategy, according to learning theory (Greve, 1998). The extent of change is constrained by mobility barriers that are resource dependent (Rumelt, 1984). In other words, a change in strategy space involves the possession of the appropriate resources.

**Industry Context**

At any time, each industry varies in terms of (1) the resource distributions of its participants; (2) the number of participants; (3) the strategic positions of participants; (4) the nature of position-performance relationships; (5) a global context in which a firm's performance is based on its distance from an optimal position, that is common to the entire industry, relative to the positions

of all industry participants: (6) a local context in which a firm's performance is based on its distance from an optimal position corresponding to its resource group, relative to the position of all industry participants; and (7) the unobservable optima in an industry that can be fixed or may vary over time.

## METHODOLOGY

For the present paper we wished to develop insights into Resource-Strategy-Performance (R-S-P) linkages by focusing on the core aspects of the issues and on contexts for which analysis and interpretation could be obtained through direct visual analysis. More computationally extensive contexts are left for future research. We describe and analyze prototypical contexts with very few firms. These contexts, by themselves, proved very useful in capturing phenomena observed in practice and providing insights into R-S-P dynamics. We analyze eight prototypical scenarios. Each scenario is a combination of the number of resource groups (1 or 2), number of optima (1 or 2) and what the referent is (best in industry, best in resource group, or best in strategic group). Based on theory, for each resource group there can be only one optimum. However, for the sake of completeness we have also considered contexts in which there are two resource groups but just one optimum. In contexts with just one resource group, the best in the industry is also the best in the resource group. That is why there are only eight contexts and not nine that have been analyzed. In our quest for insight we focus on strategy change explicitly.

[Insert Table 1 about here]

As discussed in the previous section, change in strategy is dependent on resources. Our discussion of strategy change, in the following section, implicitly assumes that the resources to do so are available. The insights available about industry dynamics are quite powerful with the parsimonious model we have employed. Increasing the scope of the model will certainly add completeness and allow for more elaborate insights to be drawn. We wish to make a first case for the usefulness of our approach and have limited our scope in this paper.

## ANALYSIS RESULTS

For the sake of clarity and ease of presentation of the analysis, firms are modeled as positioned in a two-dimensional strategy space. The optimal position in an industry is assumed to be unknown. So, strategy change is assumed to occur in the direction of a reference position. Firms are said to exhibit three types of world-views: (1) firms may choose to use the position of the best performer from their resource group as their reference; (2) firms may choose to use the position of the best performer from their strategic group as their reference; or (3) firms may use the position of the best performer in the industry as their reference. Firm performance is modeled to be inversely proportional to its distance from its optimum and inversely proportional to the firms' density around this optimum.

*Scenario 1: One Resource Group, One Optimum, and Industry Best Performer as Referent.*

Consider a scenario, shown in Figure 1, in which all the firms belong to the same group (resource and strategy) and with a fixed but unobservable optimum. Let us assume that two of the firms (1 and 4) are closer to the optimum than the others. The best performer in the industry is used as referent. The referent is also the best in the resource group as there is only one resource group.

[Insert Figure 1 about here]

To start with, in Figure 1, Firm 4 is closest to the optimum. By the rules of change, based on learning theory, Firm 4 will not change its strategy till it is no longer the leader. So, at some period in time, another firm will become closer to the optimum than Firm 4 is to the optimum. In the situation depicted in Figure 1, this closer firm is likely to be Firm 1 as it is closer to the optimum than are the other firms. So, when Firm 1 takes over the leadership, it will not change its strategy, but the other firms will. Firm 4 may then become the leader and then stop moving (This may explain why so many leading companies praised in the business press tend to lose their leadership position). This process will continue till all the firms are at the same position and no further change will occur. Slower changing firms that start far from the optimum may find themselves not profitable and exit. In this scenario the positions and performance of the others

will converge over time (may or may not be at the optimum) and profits will be competed away. This situation is graphically represented in Figure 1.

**Result 1: Strategies converge even though performance leadership varies.**

*Scenario 2: One Resource Group, One Optimum, and Strategic Group Best Performer as Referent.*

In Figure 1, if a proximity-based strategic group analysis were to be performed, Firms 1, 3 and 4 are likely to be grouped together and Firm 2 is likely to be in a group by itself. If the firms used the best performer in their strategic group as referent, then Firm 2, which is the best performer in its group, will not change and will remain a weak performer. Firms 1, 3 and 4 will converge. So, in spite of there being just a single optimum, two strategic groups will persist and the performance difference between them will be significant. Firm 2 while being the best performer in its group could perform even better if it recognized that its referent should be the industry not the strategic group. The scenario discussed here will lead to a clearer development of strategic groups over time. There could be a group around Firm 2, and the above discussion regarding Firm 2 would apply to this group just as well. In Scenario 2 the strategic group around Firm 2 will be able to diagnose the problem as that of the pursuit of a wrong referent, as the performance of the group, as such, compared to the other group(s) will decay.

**Result 2: Strategic groups separate in both performance and position.**

*Scenario 3: Two Resource Groups, Strategic Groups, One Optimum, and Industry Best Performer as Referent.*

Figure 2 shows an illustration of how this scenario unfolds over time.

[Insert Figure 2 about here]

Firms 1 and 2 are close together in strategy space, as are Firms 3 and 4 and the two pairs are quite distant from each the other. This positioning would imply the presence of two strategic groups in traditional analysis. However, let all the firms in the industry use the best performer in the industry as referent. Further, let us assume that there is just one fixed and unobservable optimum. As in the previous scenario, the firms, will move towards the industry leader. The industry leader will not move during the time that it is the leader. At some point in time, therefore, industry leadership, and therefore, the referent will change. One can also observe from Figure 2 that the firms belonging to the same strategic group appear to move in relatively similar directions, compared to members of other strategic groups. Firm performances will vary as leadership changes and as firms occupying varying positions with respect to the optimum. Again, as in the previous scenario, firms will converge in strategy to a single value and similarly in performance also to a single value. The concept of strategic groups here would imply that a group's members are likely to change strategies in similar directions. Implications for performance differences either within or among groups are hard to draw. It depends on specific positions and so empirical studies that find that strategic group analysis does not lead to explanations of performance differences are right (e.g., Cool and Schendel, 1987). But that does not vitiate the notion of strategic groups. For, strategic groups do convey information regarding the similarity with which members of a strategic group change their strategy.

**Result 3: Even with multiple strategic groups firms converge to one position.**

*Scenario 4: Two resource Groups, One Optimum and Best Performer in Resource Group as Referent*

Assume two resource groups and a fixed unobservable optimum as in Figures 3a and b. Firms 1 and 2 belong to the same resource group and Firms 3 and 4 to another resource group. Firms belonging to the same resource group are shown to be distant in strategy space to preserve the possibility that there may not be a one-to-one mapping between resource groups and proximity in strategy space. The best performer in each resource group is chosen as referent for that group.

The difference between Figures 3a and 3b is the relative location of the firms that belong to a resource group. In Figure 3a firms that belong to a resource group are on the same side of the optimum whereas in Figure 3b they are on opposite sides.

[Insert Figure 3 about here]

In such a scenario, the initial configuration plays an important role. If the two groups are initially separated, each on a different side of the optimum, as in Figure 3a, we will observe intra-resource group convergence with the groups staying apart. That is two different stable points will be observed, one for each resource group. If proximity in strategy space is used to identify strategic groups, then Firms 1 and 3 will be members of a group and Firms 2 and 4 that of another. While, initially the performance of the members of a strategic group may be similar and different from that of another group, such a pattern is likely to vanish over time as the firms adapt towards their referents. The proximity-based identification of strategic groups will convey little information either about performance or about directions of strategic change. If the two groups are scattered around the optimum, we will observe convergence toward the optimum, and the group structure will tend to disappear.

In Figure 3b the two groups are initially positioned such that the members of each group are on opposite sides of the optimum. Over time all the firms will converge. Proximity in strategy space-based strategic grouping is not likely to yield significant performance or strategy change direction information. Individual firm performance is likely to vary over time both in absolute terms as well as in relative terms as the firms move closer to the optimum and to each other.

It should also be noted that a firm that breaks away from the pack (i.e., doesn't use the resource group best as referent) and identifies the optimum may be better off than all the others in the scenario of Figure 3a and not that of Figure 3b. Once convergence is reached, strategic groups and resource groups will have a one-to-one mapping. But performance differences between groups may exist in the scenarios captured by Figure 3a. For scenarios captured by Figure 3b, as all the firms converge to the same position, no inter-group performance differences will be

observed. In summary, initial conditions matter in terms of the evolution of the structure as well as the referent that may be valuable to follow.

**Result 4: Number of stable points depends on initial symmetry conditions.**

A "same side" effect occurs when the initial configuration result in the fact that all the firms of the industry if one optimum, or all the firms of a group if several optima, are positioned on the same side of the optimum (or optima). This configuration is represented in Figure 4. The dashed line links the best performer to the optimum, the plain line is perpendicular to the dashed line and represents a boundary for the all the firms as long as the best performer stays at the same place and that it remains the referent.

[Insert Figure 4 about here]

Figure 4 shows a situation where all the firms are on the same side of the unobservable optimum. In such a situation, if referent does not move and if all firms remain on the same side (i.e., if there is no irrational strategy change), then: (1) convergence will occur until all the firms have approximately the same position and an equal performance, and then no further movement unless a disruption occurs; (2) the referent will remain best performer and sustain its leadership, but the relative performance of all the firms is likely to show non monotonic change because of the combination of distance and density effects; and (3) industry or group performance as well as the performance of all the firms will decline. The industry or the group will become less attractive.

Even if the referent moves, as long as it is not "leapfrogged" by another firm, it will sustain its leadership and all the other firms will remain on the same side until the referent overshoots the optimum. If the referent maintains momentum and continues to move in the same direction, it will lose its leadership. If it stops, it will retain its leadership either solitarily or as shared with the other firms.

A same side condition is not maintained if the referent moves and passes the optimum changing the same side configuration of the industry or of the group. Then a change in leadership is likely to occur (*cf.* Result 1). If a firm follows a "wrong" referent, it may cross over from being on the same side as the referent to being on different sides of the true optimum for its group, and then the same side condition will not be maintained.

A limit to the approachability of the referent may exist. Such a limit may result from bounded rationality (Simon, 1957), mobility barriers such as patents (Caves and Porter, 1977), causal ambiguity (Reed and DeFillippi, 1990), and/or the density argument (Peteraf, 1993). What it is not clear is the behaviors of firms facing these constraints. The best performer, for example, will see its performance decrease as the other firms close up to it even if it does not move from its dominant position as per the density criterion. This drop in its performance may trigger a change in strategy making it a moving target for the other firms and starting a state of hypercompetition as described by D'Aveni (1994) or Miller and Chen (1994). Anther possibility is that one of the followers decides to experiment and search for the optimum by itself and stops following a leader with diminishing performance. Such a situation is likely to break the same side configuration and create a situation where two best performers emerge. The rest of the firms split into two groups as some follow the leader and the others follow the other firm. Such a situation is graphically shown in Figure 5.

[Insert Figure 5 about here]

*Scenario 5: Two Resource Groups, One Optimum, and Best Performer in Strategic Group as Referent*

The first observation is that if the strategic groups correspond to the resource groups (i.e., if members of a resource group belong to the same strategic group and vice versa) then the behavior in this scenario will be similar that in Scenario 4. If so, the best in a resource group will also be the best in the corresponding strategic group.

However, if the proximity-based strategic groups are different from resource groups, then each strategic group will converge to a possibly different position and performance differences between the strategic groups will be *ad hoc*. Further fewer inter group movements are likely to be observed in such a scenario.

**Result 5: Convergence to a few points with inter group performance differences being ad hoc**

*Scenario 6: Two Resource Groups, One Optima for each Resource Group, and Best Performer in Industry as Referent*

For this scenario assume the existence of two resource groups and two fixed unobservable optima, one for each resource group. A key assumption is that the firms do not recognize either strategic or resource groups, and are concerned only with industry level indicators. Figure 6 illustrates such a scenario.

[Insert Figure 6 about here]

In Figure 6, to begin let Firm 2 be the best performer in the industry (it is closer to its resource group's optimum than any other firm is to its respective resource group optimum). All the firms will adapt towards it. As they adapt, say Firm 1 gets (unbeknownst to it) closer to the five-pointed star, its resource group's optimum than Firm 2 is to its optimum. All the firms will now move towards Firm 1. In this scenario, considerable variation in firm performance and strategy will be observed. Industry leadership will change hands frequently and any strategic group analysis that is carried out will reveal considerable flux in strategic group membership.

**Result 6: Considerable volatility in firm performance and directions of adaptation from period to period.**

*Scenario 7: Two Resource Groups, One Optima for each Resource Group, and Best Performer in Resource Group as Referent*

For this scenario assume the existence of two resource groups and two fixed unobservable optima, one for each resource group. The members of a resource group realize the existence of different optima based on resource group membership, but since the optima are not observable or known, the best performer in each resource group is chosen as referent for that group. Figure 7 illustrates such a scenario.

[Insert Figure 7 about here]

Firms 1 and 2 belong to a resource group and Firms 3 and 4 to another. Based on the starting condition, Firm 2 is the referent for the first resource group and Firm 4 for the second. Firm 3 will move in the direction of Firm 4 and Firm 1 will move in Firm 2's direction. Over time Firms 1 and 2 will converge, as will Firms 3 and 4. Of course, technically there might be a point when both firms in a resource group have the same performance but not the same position. However, we expect that with more firms in a resource group the chances of this are low, unless the firms are all positioned quite close to each other. So while the members of a resource group will converge, different resource groups will have different convergence points. Or, in other words, resource groups will diverge. So, again simple initial conditions and rules lead to complex industry structure.

**Result 7: Divergence occurs between resource groups.**

*Scenario 8: Two Resource Groups, Two Optima, and Strategic Group Best Performer as Referent*

Assume the existence of two resource groups and two fixed unobservable optima, one for each group and that the best performer in each strategic group is chosen as the referent by members of that group. There are three possible sub conditions. In the first, members of a resource group are also close together in strategy space and so there is a one-to-one mapping between the two groupings. In this condition, the industry will consolidate (or converge) into a few definite tight

clusters. Performance differences between groups will become smaller. Differences in performance variations of group members from one group to the other will depend on the number of firms in each group. In the second sub condition, there is no mapping between resource group membership and strategic group membership. In this condition, firms using the best in their strategic group as referent will be chasing false goals and industry wide performance is likely to decline (this result may not be true if all the optima are clustered together–if they are then presumably they should be considered as just one optimum) and the industry is likely to remain in a perpetual state of seemingly "disorderly" changes in strategy. Figure 8 illustrates this situation.

[Insert Figure 8 about here]

In the third and final sub condition, a hybrid may occur with some members of a resource group being close together (called matched firms) in strategy space and others not (called mismatched firms). In such a situation, the matched firms will converge and the mismatched firms will eventually settle down but with perhaps considerable deviation from their optimal performance.

**Result 8: Match between resource groups and strategic groups determines industry dynamics.**

## DISCUSSION AND ISSUES

The results presented above open a wide array of new questions. To discuss these questions, we regroup them around three areas: (1) strategy adjustment direction, (2) strategy adjustment magnitude, and (3) resource change.

### Strategy Adjustment Direction

In our model, we assume the optimum to be unidentifiable, and therefore firms adjust their strategy toward a referent rather than toward the optimum. A question is therefore: "Is it necessary to use a firm's position as a referent and not directly identify the optimum?" A possible answer may be that firms do not believe or have not thought of an optimum, and

referent provides a benchmark. Why do not firms estimate optima?–i.e., use Resource-Strategy-Performance (R-S-P) models? PIMS models in a sense provide R-S-P models but assume linearity and vector models for optima–i.e., more is better. White (1981) argued that firms cannot know or even easily guess the tastes of the customers, so they do not make their decisions based on knowledge of the potential niche. Rather, firms see only the realized market outcome, given a certain distribution of competitive firms' positions, which means that they can only try to maximize their performance by making small adjustments from their current position. On the other hand, there exists a considerable body of work, in marketing, on the identification of consumer perception and preference structures, and their use in optimal product positioning (e.g., Sudharshan, May and Shocker, 1987; Green and Krieger, 1989). But corresponding work on other aspects of firm positioning does not seem to exist.

**Strategy Adjustment Magnitude and Resource Change**

In our model, we assume implicitly that firms change their strategy as much as possible under resource constraints. However, it is possible that the function relating the transformation of resource to strategy changes over time. What are the consequences of such changes? What makes it change? How can we calibrate this transformation function? Should it be calibrated at the industry, resource group, strategic group, or firm level? Changing position on each strategy dimension takes resources. How do resources change over time? Do they accumulate, erode, or are they used up? Rumelt (1984) argues that resources such as reputation and customer loyalty may be damaged if a firm attempts to enter expanding markets far from its traditional domain, or offers lower quality products that could weaken customers' identification with the firm. How does resource change with performance? Is it automatic for some dimensions? Is it by conscious choice for others? Is there a positive returns or diminishing marginal returns? Are some resources fixed? Does a simple structure exist for resource factors? These questions need further investigations.

## MANAGERIAL IMPLICATIONS

Our paper provides several implications for managers. It highlights and demonstrates the need to understand the resources of the firms in an industry, with particular concern towards identifying firms with similar resources. It demonstrates the importance of the strategies of a firm's resource

group members in the choice of its referent for strategy changes. It also points to a need to understand the effects of convergence of firms towards an optimum. It shows for example that a firm that changes its strategy toward a referent that has a superior performance may not improve its performance for two main reasons: (1) the identified best performer may be the wrong leader to follow because it is endowed with different resources; or (2) the move toward the optimum may increase the density around this optimum to a point where the position advantage is negated by the density effect. The first reason calls for a careful analysis of the resources of firms in the industry, identifying fellow resource group members and identifying the best in the resource group to use as a referent. The second reason calls for the understanding of the trade-off between position and differentiation advantages and a careful mapping of performance changes at both the firm level as well as at the group level. Leveling off or a decline in both after increases may imply the growing maturity of the industry and provide a compelling reason to innovate and create a new valuable type of resource. Such innovation may lead to structural changes in both the strategy and resource spaces that would be tantamount to changing the rules of the game or the nature of the industry itself.

Based on our results we also offer some insights into the industry context and firm level diagnostics that might be implied by (1) observations of firm and group performance and (2) firm performance and change in strategic group membership.

The insights we are providing are related to the measurements that are commonly discussed and carried out. Table 2 shows the industry context most likely to occur under the four conditions given by decline or improvement in the average performance of a firm's reference group (a firm may be using either resource group or strategic group as referent) and changes in the firm's own performance. When both firm performance (FP) and average reference group performance (ARGP) decline it indicates that the wrong referent is used by many members of the reference group and/or that there is increasing density around false referents. In such situations, the firm should reexamine its referent. When FP declines and ARGP improves it means that the firm has not changed its strategy sufficiently. If so, it should examine its reinvestment policy in resource building or look to building up its metacapabilities. When FP improves and ARGP declines it implies that the wrong referent is used by others and the right referent by the focal firm, or that

the focal firm is experiencing the benevolence of luck. So, the firm should carefully monitor the situation to identify which of the two is the true context. When both FP and ARGP improve it means that the right referent is used by many firms belonging to the reference group and/or that these firms have adapted such that their density around the optimum does not compete away their performance. In this context the firm should be careful and continue with adaptation as well as look for ways to innovate in preparation for an eventual increase in density and decline in performance.

[Insert Table 2 about here]

Table 3 provides the diagnostics for the four types of contexts represented by changes in firm performance and in its strategic group membership. The reason why we are using strategic groups in this table is because there is a considerable body of work in both the academic and practitioner literatures and also because strategic group memberships are easier to identify. In Table 3, when a firm's strategic group membership (SGM) does not change and its performance (FP) declines it means that the firm wrongly follows the best performer of the strategic group as referent and that the density around the wrong referent is such that performance is likely to be competed away. In such a context, the firm needs to change its world-view from that of strategic groups to that of resources. When a firm's SGM does not change and its FP improves it means that the firm follows the correct referent in an industry that has reached maturity (i.e., there is a match between resource and strategic groupings). If resource and strategy groupings do not match in its industry then the firm might have be blessed by the benevolence of luck and cursed by its resulting complacency. If the industry is immature, the firm should reassess its referent. When a firm changes its SGM and yet its FP declines it means that it is wrongly following the best in the industry as a referent. This can be known because (1) the firm has changed its strategic group which implies that it is not following the best in its strategic group as referent and (2) its performance is declining which implies that it is not following the best in its resource group either. So, it must change its world-view and follow the best in its resource group. When a firm changes its SGM and yet its FP improves, it means that it is following the best in its resource group as referent. In such a context, the firm should keep on moving in the direction of

this referent, and be aware that in some point in time the density will be such that its performance will start to decline.

[Insert Table 3 about here]

## CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

We have provided an analysis of industry dynamics by integrating building blocks from various streams of literature. Our analysis demonstrates that complex behaviors can emerge, as in other fields, from simple rules. Performance variations can be explained based on simple rules of change (i.e., referent based) and industry context and configurations (i.e., positions of optima and firms' strategies) and does not need explanations based on random behavior on the part of managers (Singh, House, and Tucker, 1986). The patterns in the seemingly random behavior may be discerned by viewing the industry with a holistic perspective that includes resources, strategies, performance and the rules of adaptation. Such a view is possible to develop. Our present paper provides a first cut analysis using such a view.

A model incorporating the principle of minimum differentiation (Hotelling, 1929) captures the notion that firms can get closer towards their optimum and yet show declines in performance. This model is sufficient to capture the life cycle effects of declining industry profitability and perhaps shake out as firms that are the poorer performers might exit (or die). Firms may also exit because their performance declines even though they have followed a superior performer–if that is the wrong referent for those firms.

By modeling firm behavior as being referent driven and allowing for resource and strategy commonalities and differences between firms our model allows a richer understanding of industry dynamics to be arrived at. An *ex ante* explanation of strategic group shifts by firms is possible to be provided by their following their resource group leader who might be in a different strategic group. Initially, the appropriate strategy for a given resource bundle may not be known. However, observations of performance may quickly reveal the superior performers in a resource group and if firms follow their resource group leaders then they are likely to change strategic

groups. In a similar way, firms that follow their strategic group leaders, if they are the wrong referents, lead to observed variance in performance within strategic groups. Our efforts permit the modeling of changes in strategic groupings over time and to understand when stable structures are likely to emerge and when not. Whether performance varies between strategic groups depends on whether there is a match between strategic groupings and resource groupings and on whether different resource bundles are structurally associated with different returns.

This is however only the first phase of a research program. The next phase of the research should involve extensive computations to study a broader range of possible contexts. Following that, the hypotheses generated by the first two phases will then have to be tested empirically. In closing, we have provided an integrated yet parsimonious effort at modeling the dynamics of an industry in terms of strategy changes by firms, changes in strategic groups and groupings, performance variations over time changes, and the core relationships between resources, strategies and performance. The first cut analysis reported in this paper already provides rich insights. We are confident that the extensive computational and empirical work that will follow will add considerably more insight, diagnostics, texture and managerial guidance.

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**Table 1: Presentation of the Scenarios**

| Scenario | Number of Resource Groups | Number of optima | Referent: (best in) | Figure |
|---|---|---|---|---|
| 1 | 1 | 1 | Industry | 1 |
| 2 | 1 | 1 | Strategic Group | 1 |
| 3 | 2 | 1 | Industry | 2 |
| 4 | 2 | 1 | Resource Group | 3 |
| 5 | 2 | 1 | Strategic Group | 3 |
| 6 | 2 | 2 | Industry | 6 |
| 7 | 2 | 2 | Resource Group | 7 |
| 8 | 2 | 2 | Strategic Group | 8 |

**Table 2: Possible Observations and Conjectures about Industry Context**

| | | **Average Reference Group Performance** | |
|---|---|---|---|
| | | Declines | Improves |
| **Firm Performance** | Declines | • Wrong referent used by many.<br>• Increasing density around false referents. | • Not enough relative change or increasing density or rivalry. |
| | Improves | • Wrong referent used by others.<br>• Temporary/lucky closeness to the "true" optimum. | • Right Referent.<br>• Right adaptation magnitude. |

**Table 3: Diagnostics Based on Changes in Firm Performance and its Strategic Group Membership**

| Strategic Group Membership | Firm Performance: Declines | Firm Performance: Improves |
|---|---|---|
| No change | • Wrongly following best in strategic group as referent.<br>• Increasing density around false referents. | • Following correct referent in mature industry with match between resource and strategic groups.<br>• Temporary luck |
| Changes | • Wrongly following best in industry as referent. | • Following best in resource group as referent. |

**Figure 1.**
**One Group, One Optimum, and Industry Best Performer as Referent**

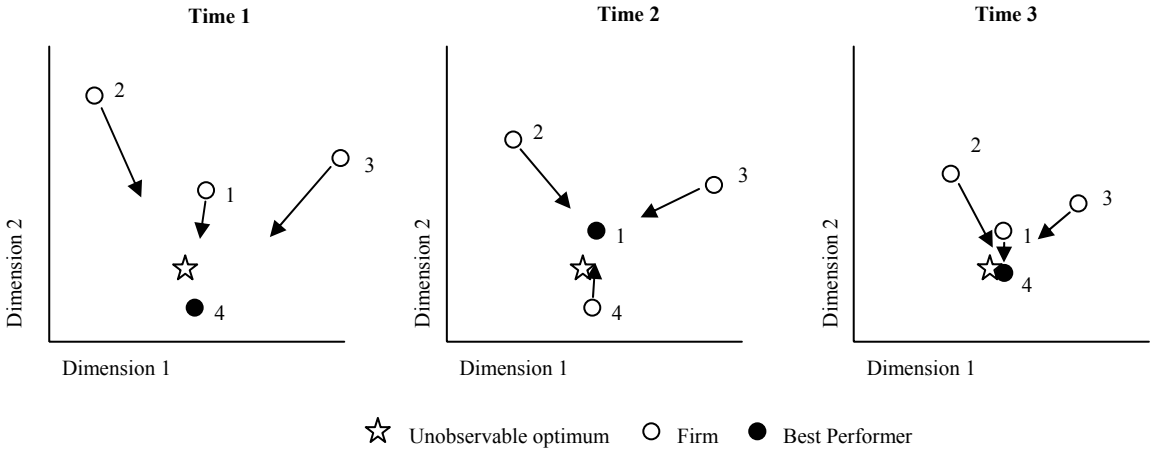




**Figure 2.**
**Two Strategic Groups, One Optimum, and Industry Best Performer as Referent**

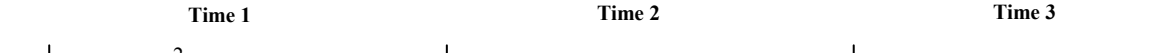

**Figure 3.**
**Two resource Groups, One Optimum, and Industry Best Performer as Referent**

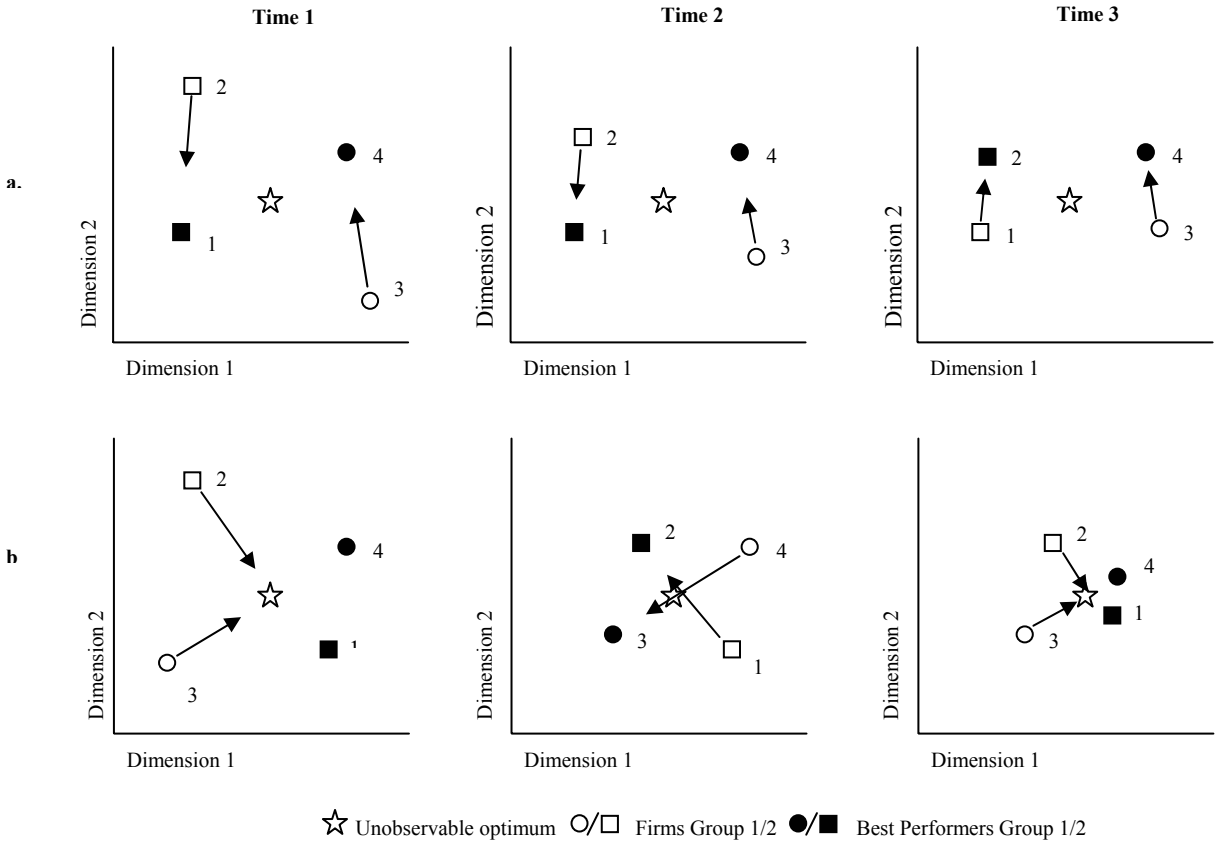

**Figure 4.**
**Illustration of the Same Side Effect**

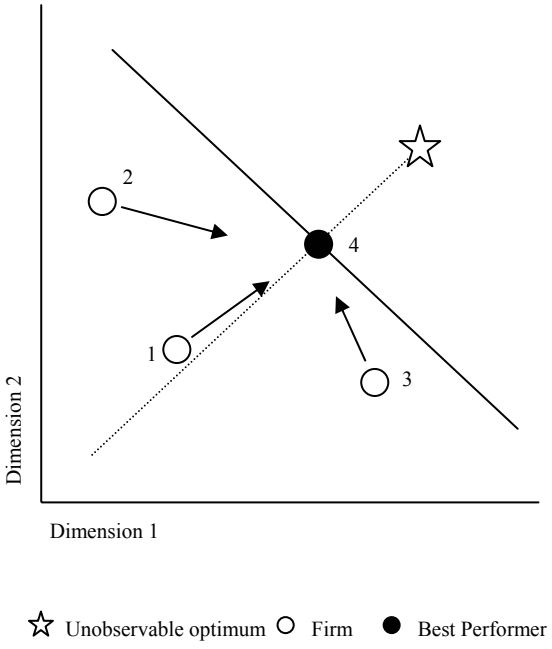


**Figure 5.**
**Limited Approachability Effect**

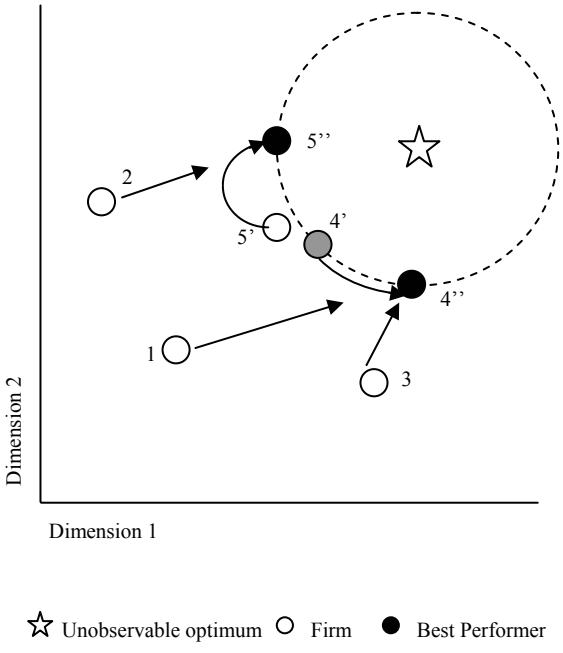

**Figure 6.**
**Two Resource Groups, One Optimum for each Resource Group, and Best Performers in Industry as Referent**

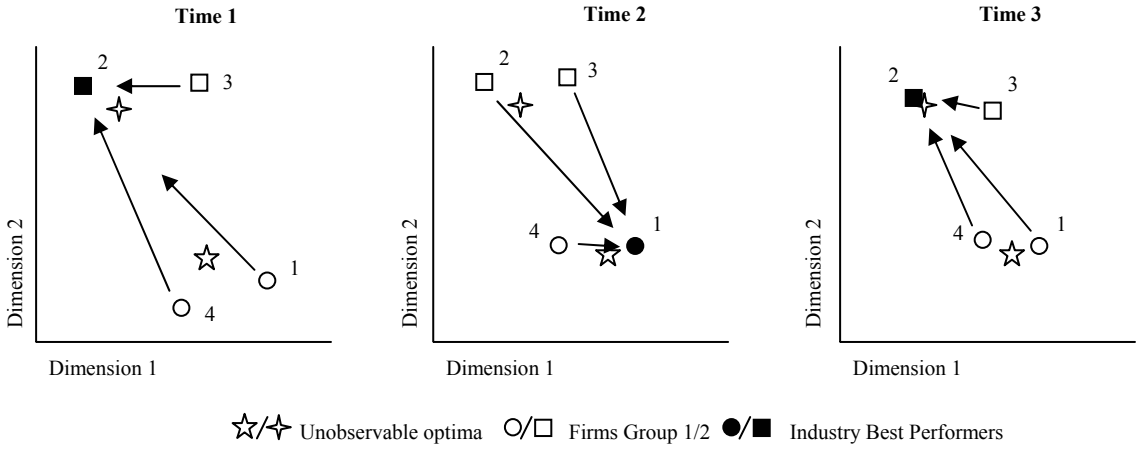


**Figure 7.**
**Two Resource Groups, Two Optima, and Resource Group Best Performers as Referent**

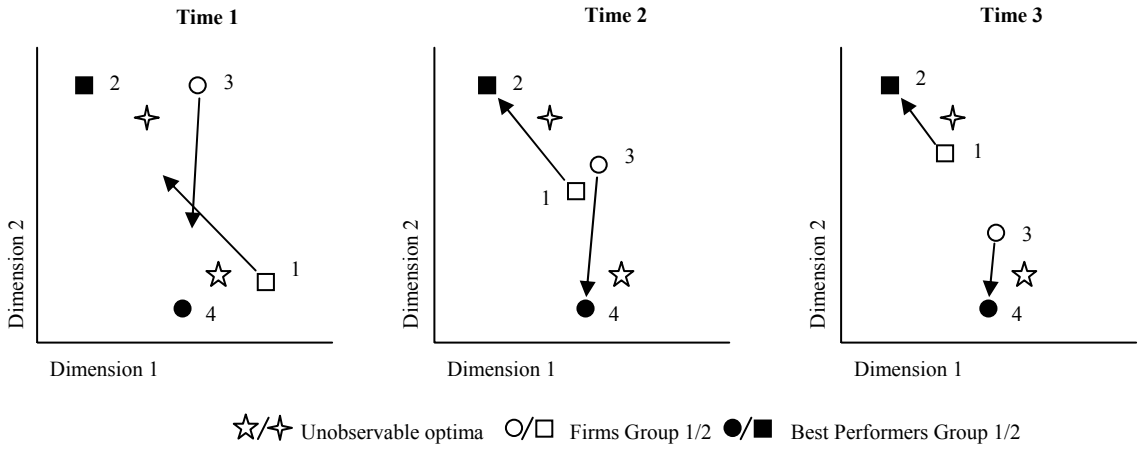

**Figure 8.**
**Two Resource Groups, Two Optima, and Strategic Group Best Performers as Referent**