CREATING COMPETITIVE ADVANTAGE

THROUGH DYNAMIC RESOURCE INTERACTIONS

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ABSTRACT

In the context of the resource-based view, some researchers have pointed out that individual resources are not valuable by themselves, but produce value only in combination with other resources. For example, resource flows need to accumulate over time to display characteristics of complexity. If complex behavior manifests in characteristics of complexity, then some fundamental questions follow: What kinds of resource combinations create value? How should resources combine to demonstrate complex behavior? What is the role of complex behavior in generating and sustaining competitive advantage? Our belief is that a collection of resources that interacts within itself in specific manners to produce complex behaviors, over time, could be a source of value to organizations. We hypothesize that the nature of resource interactions influences the resource system's context, whose complex dynamics moderates the relationship between discrete resources and performance.

Employing a modeling philosophy that builds on the frameworks suggested by recent advances towards a dynamic resource-based view in conjunction with a time-evolutionary perspective, this paper seeks to explain the divergent performance profiles presented by two almost identical branches of an insurance firm. Different simulations are carried out to examine the consequences of particular sets of interactions on identical initial resource heterogeneity. The simulations differentiate the impacts of initial resource heterogeneity and interaction amongst resources in contributing to the complex behavior of resources. Some conclusions are drawn about the significance of these two factors in the generation and sustenance of competitive advantage.

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INTRODUCTION

One of the most critical issues in strategic management literature is to address the question: How is value created? Research developments in the last two decades have come up with the resource-based view, which postulated that inter-firm differences in performance arise from the heterogeneity of resources in firms, sustained by resource position barriers (Wernerfelt, 1984) or by imperfections in strategic factor markets (Barney, 1986; Barney,1989).

Further query into the source of resource heterogeneity has usually produced two kinds of answers. On one hand some have pointed to the limited supply of certain kinds of resources (Barney, 1991; Peteraf, 1993). On the other hand we also have explanations based on the complexity of resources - e.g. they are causally ambiguous (Amit & Schoemaker, 1993), they are difficult to copy precisely (Barney 1991), they need time to be copied or imitated (Dierickx & Cool, 1989), etc.

Exponents of competencies and capabilities (e.g. Hamel & Prahalad, 1990) and others like Grant (1991) and Black & Boal (1994) proposed that resources are not necessarily valuable by themselves, but only in combination with other resources. Collis (1994), Barney & Zajac (1994) and Miller & Shamsie (1996) are among those who proposed that the value of a resource derives from its context. For Porter (1991), value creation centers on 'activities' that display characteristics of complexity. The implication is that these value-creating characteristics derive from complex behaviors of resources that have somehow combined together.

However, few have explained how bringing together discrete resources create complexity characteristics, whether all kinds of complexity create value and the potential role of managers in value creation using complexity. Even when resource combinations do create value, is the value creation due to the number of different resources that have gone into making them complex (detail complexity[1]) or is it due to the special way in which the resources have been combined (dynamic complexity)? In the strategic management literature, there seem to be very few explanations as to what kind of combinations of resources or what kinds of contexts of resources create value.

If value is a function of combination and context, then we can proceed by refining this into a proposition: Value creation can arise from the dynamics of a collection of discrete resources, which is part of and evolves in the environment of a given context[2]. Miller (1986, 1996) emphasizes the inadequacy of the contingency approach for strategy research. For Porter (1991), the cross-sectional approach to strategy needs to be supplemented by a longitudinal approach. Together, these imply that a more dynamic approach is needed to explore the mechanisms of value creation while adding on a temporal dimension. A beginning towards this has been made by Dierickx & Cool (1989), who point out the role of time and

[1] Complexity resulting from the presence of a large number of interacting elements is 'detail complexity' while complex behavior of resources (over time) that arises from the consequences of the particular way(s) in which resources are combined is called dynamic complexity. See Sterman (p. 21, 2000) for more details.
[2] At a given instant, a context is the resource network made up of the joint impacts of different initial conditions, managerial choices and resource configurations, in addition to the discrete resources themselves.

accumulation as vital facets in bestowing characteristics of complexity and in eliciting complex behavior[3].

To study the traits of complexity and what elicits complex behavior, due consideration needs to be given to resources as well as the causal linkages between resources; these causal linkages between resources lead to resource interactions[4]. This paper takes up some of these key aspects. Specifically, this paper explores the '*nature of resource interactions*' among resource sub-systems[5] and its role in creating competitive advantage.

The method adopted here is inspired by Rouse & Daellenbach's research framework (1999) for studying organizational effects by investigating ***in*** organizations. This investigation in this paper seeks to explain the divergent performance profiles presented by two branches of an insurance firm. The fieldwork is expressed as a model that is based on the representation of actual resources that facilitates subsequent simulation. In the first step we set up a map (or network) that links resources (organized in sub-systems) to other relevant resources and performance, by specifying their dynamic behavior. In subsequent steps, by changing the nature of interactions among resources and among sub-systems, this paper will show how the nature of certain interactions can influence the type of stability that prevails in the resource system. In turn, the type of stability obtained shapes the overall context, whose complex dynamics moderates the relationship between discrete resources and performance.

The rest of the paper is organized as follows: the next section will be a review with a view to support the scope and approach that is being adopted for this paper, followed by a section that summarizes the basis of the model. The ensuing section displays the results of the simulations and their analyses. The penultimate section discusses the results and its theoretical implications. The last section concludes with the results' implications for managers.

REVIEW: THEORY & APPROACH

In the previous section it was implied that particular patterns of resource combinations could create value. Specifically, resource interactions – within an appropriate context – are capable of producing, over time, complex behaviors and characteristics of complexity from the constituent resources. If a comprehensive combination of resources that influence performance of a firm is viewed as a system, then the resource system that elicits complex behavior may possess some characteristics of a complex system.

For example, a small initial difference between two otherwise identical systems can end up as a large difference in the behavior and performance of the two systems, with the passage of time. The implication for firms in a similar setting is that a tiny difference can lead to larger differential performance – thereby resulting in value creation and competitive advantage in a dynamic sense, for one of the two firms. A basic question thus follows: Can there be value creation starting from discrete resources that lack the properties of "uniqueness"?

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[3] Complex behavior is non-linear or dysfunctional behavior with respect to time.
[4] If resources A, B and C are causally linked in such a manner that A affects B, B affects C and C affects A, then resources A and B are said to interact with each other, (as also B with C and A with C).
[5] Resource sub-systems, for now, are described as activity systems – i.e. a collection of more elementary resources that are functionally-oriented and whose behavior can be determined independently of the context provided by other resources or sub-systems.

Given this property of complexity, it is natural to look away from the uniqueness of discrete resources comprising the resource system towards other features as the source of competitive advantage. We suggest two mechanisms to explain value creation. First, initial heterogeneity between the resources of two systems is compounded into larger differences due to the specific interactions that occur in the systems. Second, slightly different interactions in the systems can tweak apart the otherwise identical initial conditions to compound them into diverse complex resources, which is an example of complex behavior.

This paper proceeds to demonstrate the first of these two mechanisms. By holding the nature of initial heterogeneity constant while generating complex behavior, attention is diverted to the role of resource interactions. Specifically, the nature of resource interactions can determine the type of stability that prevails in the resource system. The type of stability obtained shapes the overall context, whose complex dynamics moderates the relationship between discrete resources and performance. This idea is sketched is Figure 1.

The nature of heterogeneity in resources can be of different kinds (Penrose, 1959), as depicted in Figure 2. She discriminated amongst resources, the productive services from resources and the link between these two (which is influenced by the firm's management) in the firm's production process. In other words, there could be a difference amongst the resources themselves or in the way in which similar / identical resources are managed. Prahlad and Bettis (1986) later emphasized this in pointing out the mechanism of dominant logic as a way of understanding the impact of idiosyncratic and heterogeneous traits of management on short-term and long-term performance (Figure 3). In this paper, initial heterogeneity of resources originates from differences in the environment, endowments or initial conditions. Heterogeneity in resource interactions arises from differences in the causal structure linking the resources and from managerial policies.

It is important to point out that there have been some recent studies that have considered the impact of interactions on organizational performance (Levinthal 1997, Rivkin 2000). In both these studies, interaction is conceptualized as a function of detail complexity, as is the approach to the treatment of interactions. First, it is postulated that an increase in the number of interactions leads to more specialization. Second, complexity from interactions increases with the number of elements that interact. In contrast, this paper focuses on the nature of interaction that plays a role in determining the context of resources. This context, in turn, moderates the performance outcome of the resources / resource sub-systems. Accordingly, this paper intends to throw light upon those interactions involving particular combinations of resources and information feedback that express complex behavior over time, rather than on those interactions which simply involve a large number of resources.

Any research method chosen to address the above questions needs to take into account the role of resource configurations, managerial choices and initial conditions to accommodate a large number of variables. The evolutionary underpinnings of Nelson & Winter (1982), Teece et al (1997) and Levinthal & Myatt (1994) hold promise in portraying the dynamics of the resources and interactions involved. Noda & Collis (2001), in a longitudinal study, show the different kinds of feedback and the dynamic interplay among market, competitive and organizational forces that guide the evolution of heterogeneity of firms in an industry[6]. The

[6] Due to a lack of quantification, Noda & Collis (2001) fail to show how the various forces interact with each other and how they influence the context in a dynamic fashion. It prevents a detailed understanding of the changing relative importance of these forces and the consequent implications for resources towards producing competitive advantage.

evolutionary approach calls our attention to three characteristics of major importance. First, instead of the maximizing behavior of managers assumed by the traditional RBV, this approach adopts 'satisficing' in the context of bounded rationality as the dominant mode of behavior, from the behavioralist paradigm (Cyert & March, 1963). Second, in contrast to the papers on interactions reviewed above, the proposed model is built around real business structures that correspond to the facts of the industry, the actual resources and their configurations; it is similar to the history-friendly modeling approach by Malerba, Nelson, Orsenigo and Winter (1999, 2001). It specifies the causal relationships among the various resources and the processes involved in the transformation of resources over time. Portraying the causal and the process structures is essential to representing the network of resources and their time-evolution[7] such that it is able to reproduce the actual behavior of the firm(s) concerned.

The third major characteristic, which follows from the causal structure mentioned above, is that the proposed model will be based on a non-equilibrium approach. Typically, equilibrium models are limited to conditions of equilibrium and do not necessarily portray what happens on the path to equilibrium[8]. They use mechanisms of rent appropriation to link the initial heterogeneity in resources to the sustenance of rents (a proxy for competitive advantage).

In contrast to equilibrium models, non-equilibrium models are more robust and complex. They provide an opportunity to clearly delve into the dynamics of resources – specifically, the sense of how resources and capabilities evolve over time. Researchers like Porter (1991, 1996), Bromiley (1993), Collis & Montgomery (1995) and Priem & Butler (2001) have highlighted the importance of this specification as it permits better operationalization to examine the propositions of the resource-based perspective. In addition, these models can separate the effects of various factors on static and dynamic bases. This paper explores initial heterogeneity and interaction among resources in the generation of differential performance (which results in competitive advantage).

Mahoney & Pandian (Footnote 6, 1992) suggest that resources could be denoted as stocks and productive services from resources could be represented as flows. Dierickx and Cool (1989), who introduced resource accumulation into strategic management literature, define competitive advantage as a function of the levels of those asset stocks that measure performance variables. Other researchers e.g. Decarolis & Deeds (1999) also conceptualize relevant kinds of resources into stocks and flows. However, they do not elaborate on how an initial heterogeneity between two firms will or will not result in a competitive advantage. With a view to integrate the resource-based, evolutionary and accumulation perspectives (represented in Figure 4), we adopt a system dynamics methodology to model a dynamic resource system in order to convey our objectives for this paper.

An important characteristic of such a dynamic resource system is that it classifies all resources into three kinds. First, there are those that do not vary with time, denoted as constants. Next, there are resources that need time to adjust from their previous value, because of the inertia of resource accumulation – denoted as resource stocks. Third, there are resource flows to and from resource stocks. These resource flows are a function of the level

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[7] Here, time-evolution is to be interpreted simply as transformation that results over the passage of time, rather than those interpretations associated with ecology. The modeling method adopted is not that adept in handling discrete events or events whose impact has not been conceptualized.

[8] Some researchers have utilized equilibrium models (Lippman and Rumelt, 1982; Oi, 1983) to explain the persistence of some given heterogeneity. But these models do not lay out the process that resources go through, on their way to equilibrium.

FIGURE 1 - A Mechanism where Context moderates Performance

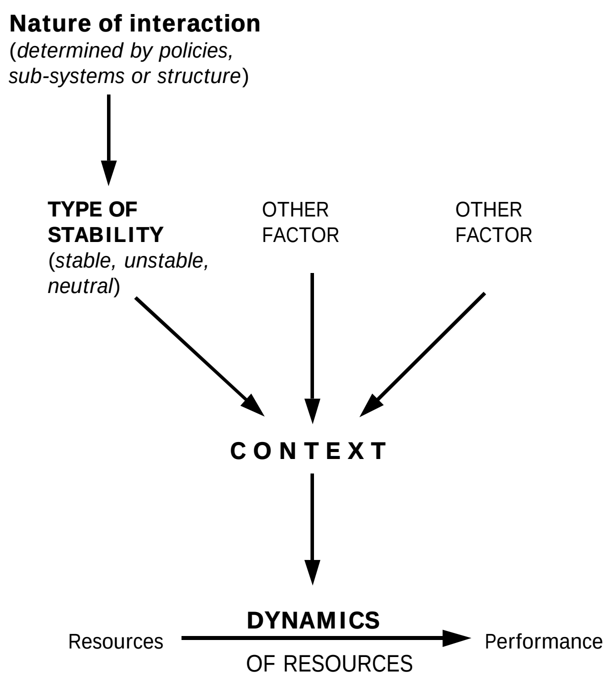


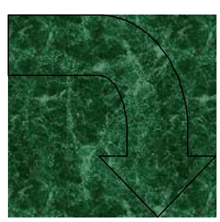
FIGURE 2 – Ideas on Competitive Advantage

Resource Based View - ***"Unique Resources are the key to achieving Strategic Advantage"***

"A firm is a bundle of productive resources" ***(Penrose's interpretation)***

- resources
- productive services
- relationship between resources

  and productive services



Differences in firm performance arise due to:

a) Possession of different resources

b) Resources are managed in a different way

FIGURE 3 - Ideas on Competitive Advantage

Competence Based View - ***"Unique Competencies are the key to achieving Strategic Advantage"***

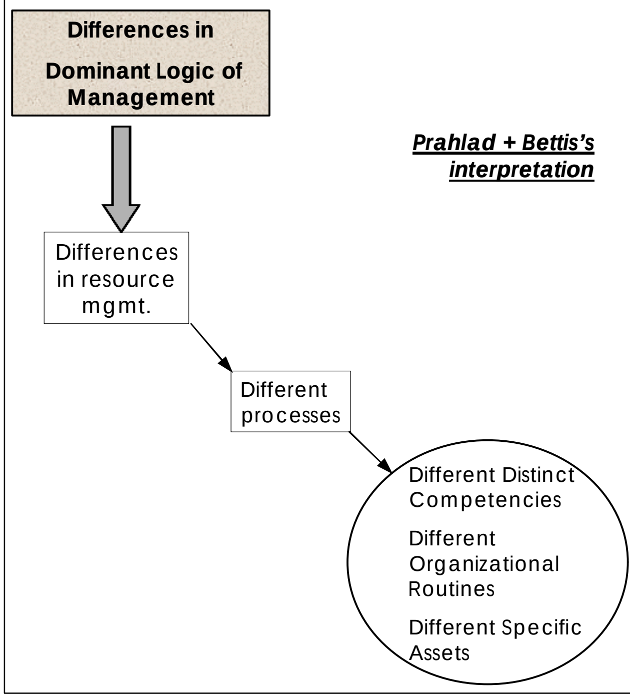
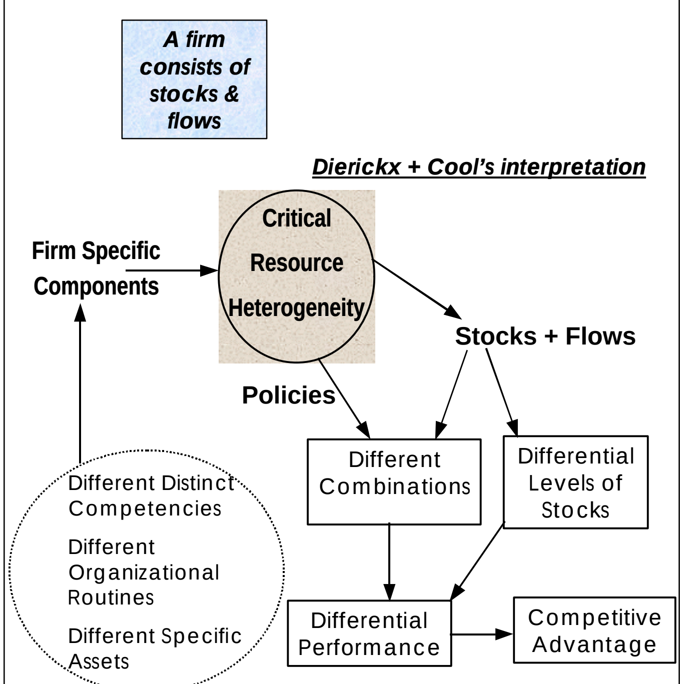


FIGURE 4 - Ideas on Competitive Advantage

Resource Accumulation View - ***"Differential Accumulation of Key Resources over time achieve Strategic Advantage"***



of the resource stocks and are capable of varying relatively instantaneously. These concepts, including that of accumulation, assimilation, information flows and material flows are explored in more detail in the system dynamics literature (Forrester, 1961; Sterman, 2000; Morecroft, 1994; Morecroft, 2000).

Probably the most outstanding feature of this method of simulation is that the model specification requires an accurate mathematical description of the activity systems prevailing in the firm. By specifying how the transformation of resources in the activity systems affects each other (with the help of differential equations), there is a clear ***ex-ante*** link between resources, resource management and rent appropriation. The causal links are essentially the building blocks of the dynamics of strategy. Moreover, they help to determine the input of management policies towards performance and bring to life Penrose's (1959) idea that management is a "dynamic interactive process". It addresses Porter's plea (1991) to explain how resources and capabilities evolve over time.

An important characteristic is that the method facilitates the impact of both kinds of feedback. Goal-seeking behavior, or negative feedback, has long been recognized as an important dynamic in the management of resources ('homeostasis') – particularly in organizational theory. Various authors (Arthur, 1989, 1990; Levinthal and Myatt, 1994) have also highlighted positive feedback. The type of feedback indicates the behavior and the overall direction of resource accumulation in the loop. If the organization is taken as a whole, there certainly exists a possibility of more than one type of feedback as well as changing types of feedback. This may make it difficult for human beings to intuitively guess the final outcome of the dynamic consequences of the time-evolution of the relevant resources.

Another major advantage of this method is its ability to quantitatively combine resource heterogeneity arising from resource endowments, from the manner in which information is processed and from actions taken about resources (management policies). Quantification of the processes studied during fieldwork allows this method to improve upon the shortcomings pointed out earlier in the approach adopted by Noda & Collis (2001).

A potentially significant application is to examine and verify the properties of resources specified by Barney (1986, 1991) and Peteraf (1993) in their exposition of the resource-based view – particularly the conditions deemed necessary to generate and sustain competitive advantage. In other words, is it possible for resources without special properties to generate competitive advantage? Can competitive advantage arise from the interactions among resources as a function of the time-evolution of the resource network rather than the discrete resources themselves?

MODEL STRUCTURE

This section summarizes the model and simulation objectives. The philosophy that leads to the model's construction is inspired by Rouse & Daellenbach (1999), who lay out a research framework for studying organizational effects by investigating ***in*** organizations. We take their suggestion about the selection process one step further by investigating a phenomenon that involves two branches of a major insurance firm in the United Kingdom. These branches were part of the same insurance group and were selling the same portfolio of products. They were similar in resource structure and management policies in almost all aspects. In addition, these branches were in markets that required similar levels of expertise from their manpower. As expected, these branches initially had comparable levels of performance, but later there was a divergence. It is the cause of this divergence in the performance level that we seek to investigate through modeling.

Appendix 1 presents a short background of the insurance industry and a brief description of the typical insurance firm in terms of its resources and activities performed. The agency (i.e. sales) department affords the greatest flexibility to firm management to establish a competitive advantage through differentiation and productivity[9]. Management decides what kind of agents (sales persons) to hire, how much training they should get, how to train them, where to spread its agents and how to identify and retain/promote its star performers. This department is responsible for the entry of new money streams, to maintain the 'going concern' status. It is also the largest cost item that can actively be managed in the business plan of the insurance company. For these reasons this paper focuses on the agency department of firms in the insurance industry.

Insurance industries have their own particular measures of profitability. These are mentioned in Appendix 2. Trends in this industry are towards distribution through direct marketing, specialization of service required by policyholders and a significant reduction in commission based compensation. The new sales-force has to be quick at learning how to tackle issues specific to their clients. Note the increase in the importance of agency management, as its role becomes more critical in delivering a competitive advantage to the insurance firm.

Since we will focus on the agency department, we will henceforth denote this department as a firm. A more detailed description of the activities for this kind of firm, along with the performance measure adopted here, is presented in Appendix 3. The activities are modeled as four sub-systems: the headcount sub-system, the skill sub-system, the productivity sub-system and the compensation sub-system. The headcount sub-system is the collection of processes directly concerned with the management of agent headcount, which include hiring, firing and promotions. The overall rates of agents moving into or leaving the firm and the number of agents have an important impact on the dynamics of the skill pool of the agents.

The skill sub-system is about the management of agents' sales skills. For purposes of simplification, multiple dimensions of sales skill have been collapsed into one dimension, which is based on the years of sales experience possessed by an agent. Even though the measure of this skill is not very tangible, it is one of the most important drivers of performance in the industry. The productivity sub-system highlights the productivity and turnover of the sales agents and the resultant dynamic impact on the product portfolio. The compensation sub-system models the mechanics of fixed and variable compensation (commission), for agents and managers. It specifies how the level of skills, the lapse rate and the quit rate of the agents affect compensation and, in turn, how the compensation level affects the same three variables.

These sub-systems are explained in more detail in Appendix 4, with the help of diagrams. The sub-systems that model the various processes addressing managerial headcount, agent learning, managerial learning, managerial responsibilities, managerial time constraints, the comparison of performance and the reaction to the comparison by managers, have all been excluded in order to simplify the model to a significant extent and keep it within the scope of

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[9] Another way in which firms in the industry differentiate themselves is through the pattern of ownership of the equity structure of the firm. However, this makes an impact only during exceptional events in the firm's history.

this paper. The discussion section reviews some assumptions behind the managerial behavior portrayed in the sub-systems in light of the actual behavior displayed by managers.

Following the approach suggested by Rouse & Daellenbach (1999), the cause and effect relationships describing the processes in the model were derived from interviews with five experienced managers from the industry and with other industry consultant experts, totaling 60 hours. Further secondary data about the major insurance firm and the insurance industry was also used to enhance information obtained from the interviews. These relationships are now being verified with published research. Industry experts have validated the behavior of the model to substantiate the link between its structure and the working of the field setting.

SIMULATION: RESULTS AND ANALYSES

We recollect here the objectives of the paper that we have mentioned in passing. The first is to demonstrate how resource interactions give rise to complex dynamic outcomes and that different kinds of initial conditions set off different time-evolutionary paths for resources. In effect, these interactions create a context that moderates the link amid resources and performance and thus results in different trajectories for performance. The second is to impress upon readers that it is possible to differentiate between the roles played by resource heterogeneity and interactions amongst resources, in an outcome that shows differential performance. The third is to contrast the properties of resources specified by Barney (1991) and Peteraf (1993) to sustain competitive advantage with the characteristics of resources and their interaction mechanisms that produce differential performance; these characteristics and mechanisms are derived from the exposition of the model in this paper.

To illuminate these points, there will be a series of simulations progressively involving more complex interactions and sub-systems[10]. In the first simulation, managers have perfect information and control about holding onto their initial competitive advantage; there should be an ideal outcome. The next is carried out under conditions of absence of / partial information and control; one expects the initial advantage to erode. The last simulation integrates the compensation sub-system. In each simulation we show the time-evolution of three very similar firms – Alpha, Beta and Gamma. Within a simulation, these firms differ from each other only in initial heterogeneity while possessing the same causal structure; they follow the same policies. Across the simulations this initial heterogeneity that distinguishes the three firms is replicated in a consistent manner. The intention is to help the reader separate the effects of resource heterogeneity and interactions amongst resources in the result.

Simulation 1 – Perfect Information and Management Control

We take a relatively simplified version of the firm independent of many of the other sub-systems that usually form an integral part of it. Imagine a firm composed of only the headcount, skill and productivity sub-systems. The composite diagram of the network of resources (or causal structure) is depicted in Figure 5. In this firm, consider an ideal situation where *managers have perfect information* about the ability of their agents and *have attained a perfect ability* to retain their superstar agents (i.e. those with extra-ordinary skill) as salespersons. In addition, they do not care about the skill level of the other agents who leave the firm or of those who are promoted.

[10] This style of adding on partial models and interactions to examine qualitative patterns of behavior is discussed further in Morecroft (1984, 1985) and Sterman (2000). It is related to the dialectic inquiry method of Mason (1969) and Mitroff et al (1982).

The (causal) structure that corresponds to this ideal equates the skill level of the agents in flux (those entering, quitting and promoted) to the average level of the skills **in the market** – and thus, nothing to do with the average skill level of the firm. It is shown in Figure 5 by the thick arrows from *Skill of Agent Quits* and *Skill of Agents Promoted* to *Lost Skill from Agent Quits* and *Lost Skill from Agents Promoted* respectively. There are no arrows from *Skill per Agent* to *Lost Skill from Agent Quits* and *Lost Skill from Agents Promoted*.

As mentioned before, there are three firms – the base case (Beta) and two additional cases (Alpha and Gamma) – that are identical except for the initial heterogeneity. All have 100 agents each at the start of the simulation. Beta has 300 equivalent years of experience in sales skills (*Agent Sales Skills*) implying an initial value of *Skill per Agent* of 3 equivalent years of experience per agent. The initial heterogeneity is introduced through Alpha and Gamma; they have 330 and 270 equivalent years of experience in sales skills respectively. *Standard Agent Skill at Hire, Relative Skill of Quits* and *Relative Skill of Promotions* are all set to 3 equivalent years of experience, which is equal to the average levels of the skills in the market. (*Standard*) *Agent Quit Rate* is set at 0.20 per year while *Agents Promoted* is set at 0.025 per year. The values assumed are within the range prevalent in the firms that were studied[11].

Figure 6 shows the behavior of these ideal firms over ten years. The final performance levels remain at their initial levels for Alpha, Beta and Gamma. If performance is measured in *Skill per Agent*, then the firms have remained steady at 2.7, 3 and 3.3 years. Similarly, the other measure, *Profitability*, is also steady at 73, 75 and 77 units respectively. The amount of *Agent Quits*, *Agents*, *Agents Promoted* and *Agents Hired* remains equal and steady for all the three.

In this simulation, the headcount policy is simply to replace those who quit (*Agent Quits*) and those who are promoted (*Agents Promoted*). As the number of such agents is proportional only to the existing number of agents, the total amount of agents in the three firms remains the same for the duration of the simulation. So does the number of *Agents Promoted*, *Agent Quits* and thus, the hired (*Agent Hires*). When it comes to agent skills (*Agent Sales Skill*), management retains the extra-ordinary performers as set out by the definition of the situation. Those leaving and being promoted, not subject to any skill restrictions, exit (and enter) at a skill level equal to the average of the market. Consequently, the skill level of the firms remains constant at their initial levels, as observed. The same lack of dynamics holds for *Profitability*.

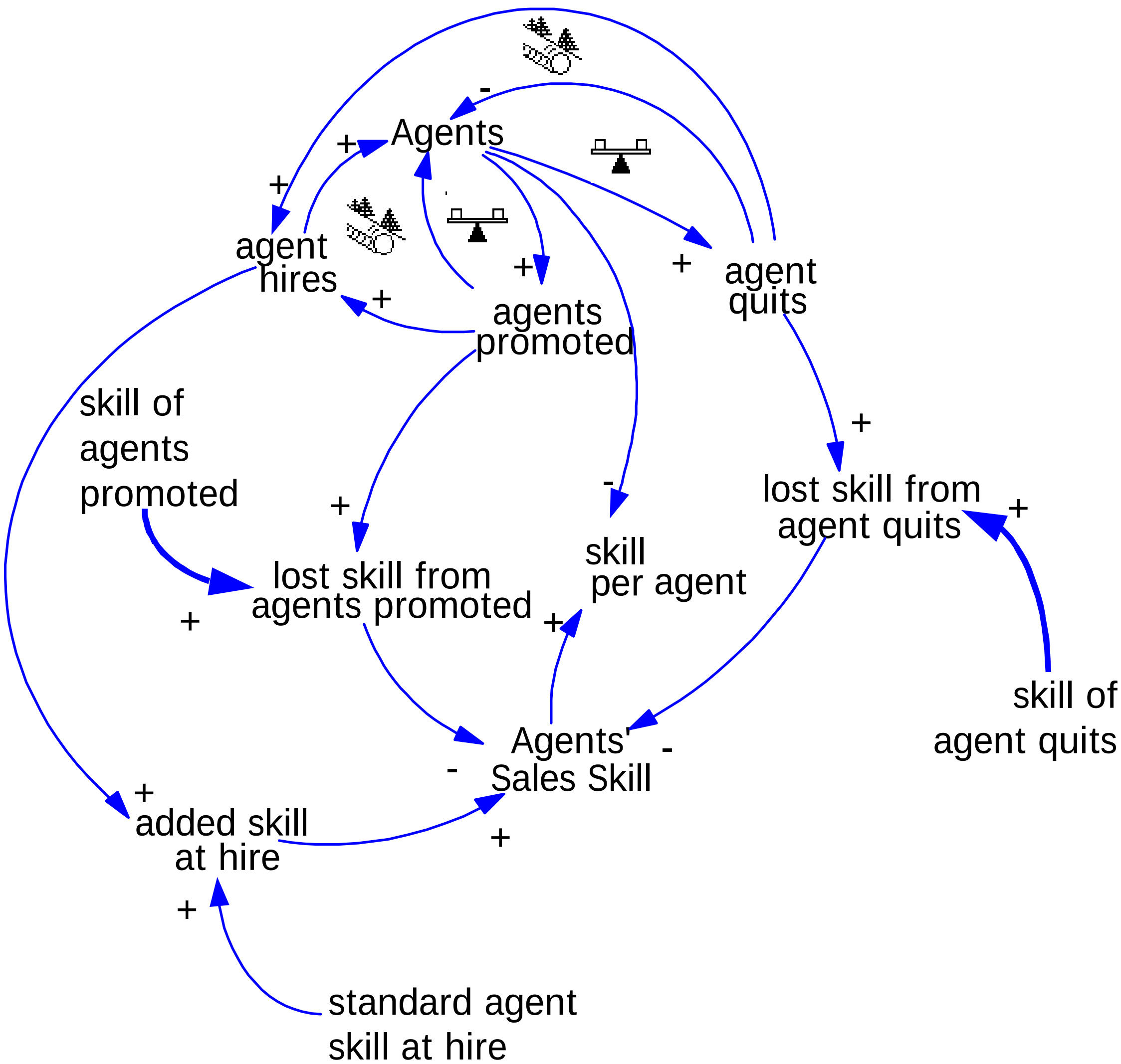
This simulation demonstrates that when managers are capable of holding on to their scarce and valuable resources, they can sustain their initial competitive advantage.

Simulation 2 – Minimal Information and Management Control

In contrast to the previous simulation, here we have another stylized situation where *managers have minimal information* about the ability of their agents and *no control* over which agents leave or are promoted. This implies a lack of ability to retain their superstar agents. Accordingly, the skill level of the agents in exit is set to the average levels of the skills **in the firm**. It is shown in Figure 7 by the dotted arrows from *Skill per Agent* to *Lost Skill from (Agent) Quits* and *Lost Skill from (Agent) Promotions*. These *Lost Skills* are no

[11] Very few of the values used have been adjusted to clarify and communicate the issues that prompted the simulation. Nevertheless, all the values being used are within the range of values that were prevalent in the firms.

FIGURE 5 - Model for Simulation 1



skill of agent quits =

skill of agents promoted =

standard agent skill at hire =

average market level of skills =

3 years of experience

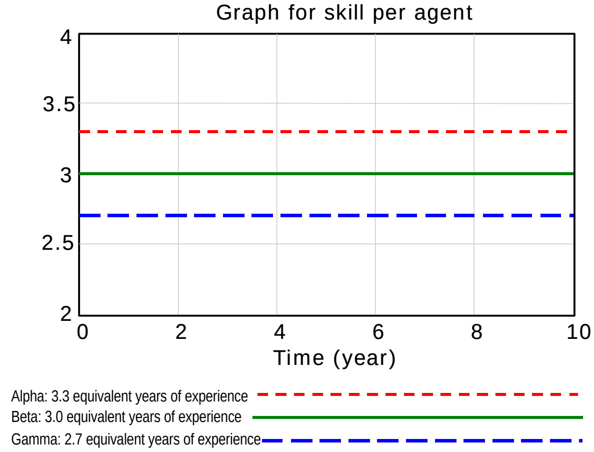
A ---+→ B An increase in A causes B to increase

A ----→ B An increase in A causes B to decrease

Reinforcing loop

Balancing loop

FIGURE 6 - Results of Simulation 1



Units: equivalent years of experience (above) and dimensionless (below)

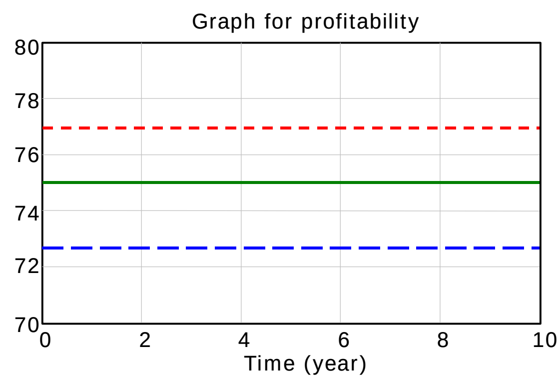
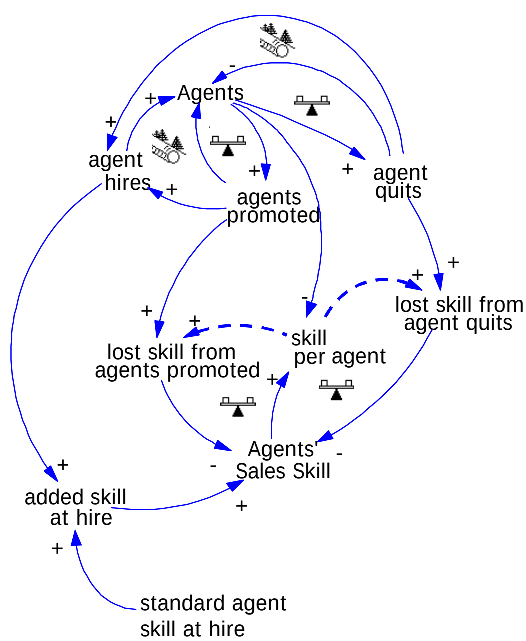


FIGURE 7 - Model for Simulation 2



longer a function of the average levels of the skills in the market. This change from the previous simulation introduces the first significant interaction amongst the resources in play; it may be almost conceptualized as a different policy in implementation.

How would the conditions that are specified above influence the performance of the firms? Since introducing this interaction brings into play two more balancing loops than the previous simulation, one expects a performance profile that is 'more stable'. However, there still remains the question, more stable with respect to what? Recall that in the last simulation, all the three firms had very stable and consistent performance profiles. As before, we proceed with the three firms, identical to Simulation 1 with respect to their initial values. *Relative Skill of Quits* and *Relative Skill of Promotions* are set to an absolute value of 1, a clear indication of management powerlessness with respect to the market. *Agent Quit Rate* is set at 0.20 per year while *Agents Promoted* is set at 0.025 per year, as in Simulation 1.

Figure 8 shows the dynamic behavior for this stylized version over ten years. It shows that Beta remained steady at 3 years in terms of *Skill per Agent* and at 75 units in terms of *Profitability*. Note that the final performance levels of Alpha and Gamma converge to that of the base case whether performance is measured as *Skill per Agent* or as *Profitability*. The number of *Agents*, *Agent Quits*, *Agents Promoted* and *Agents Hired* remains invariant over time and equal for all the three firms.

Although the headcount policy is very similar to the previous simulation, the skill retention policy is quite different. Management is almost powerless to control who leaves the firms. If agents leave the firms at random, it is equivalent to the situation where the skills of those leaving, at a given point, are the same as the average skill level (*Skill per Agent*) of the firms at that instant. This relation with the instantaneous average skill level indicates the presence of the new significant interaction whose effect is highlighted. In terms of causal structure, additional balancing loops (marked in the figure) connecting *Agent Sales Skill*, *Skill per Agent* and *Lost Skill from Agent Quits* / *Lost Skill from Agent Promoted* are active.

These additional balancing loops influence the rate of accumulation and the time-evolution of the firms' resources by modifying the interaction context that was pointed out earlier. The combined effect of the new balancing loops and other existing loops manifests through a mechanism typical of the dynamics of balance. When agents with above average or below average skills leave the firms, their substitutes are hires whose skill level (*Level of Hired Agents*) is at the average level of the market. As this mechanism plays out over time, the skill level in both Alpha and Gamma converges to that of the market and that of Beta. *Profitability* is directly linked to *Skill per Agent*; therefore it exhibits similar paths.

Modification to Imperfect Management Information and Control

To paint a scenario that is more realistic than the one immediately above, consider a situation where *managers have imperfect information* regarding which agents leave or are promoted. It continues to imply a lack of significant ability on the part of management to retain their superstar agents. The corresponding causal structure is repeated in Figure 9 by dotted arrows. The difference to the causal structure is that management exercises some control regarding who is promoted or who quits because of changes in the values of *Relative Skill of Quits* (set to 0.90) and *Relative Skill of Promotions* (set to 1.80). These are shown as thick arrows.

A value of *Relative Skill of Quits* lower than one implies that only worse than average agents quit; it increases the skill level of the remaining agents. On the contrary a value of *Relative*

Skill of Promotions higher than one implies that only better than average agents advance; it lowers the skill level of the remaining agents. While these abilities are more in line with what management would desire, their effects are contradictory. These modifications do not really affect the impact of the significant interaction that was presented in the last simulation. The performance trajectory of Alpha and Gamma converge to that of Beta, which is steady at 3 years in terms of *Skill per Agent* and at 75 units in terms of *Profitability*. All facets of the outcome are similar to the previous simulation, where managers have minimal information.

The convergence proves that the dynamics of the balancing loop(s) dominates the time-evolution of the resource context. This simulation demonstrates that when managers are incapable of holding on to their scarce and valuable resources, their initial competitive advantage gets eroded.

Simulation 3 – The Complete Model

In this simulation we integrate the hitherto neglected *compensation sub-system* with the *imperfect management information and control* scenario simulated above. The additional interaction that is now being facilitated comes not from a simple change in abilities but from the complex behavior of the compensation sub-system itself (explored in Appendix 5). From there we concluded that although there aren't any policy levers that managers consider to be practical, the sub-system functions in such a manner that deviations from the steady-state input value of compensation results in more deviation before stabilizing.

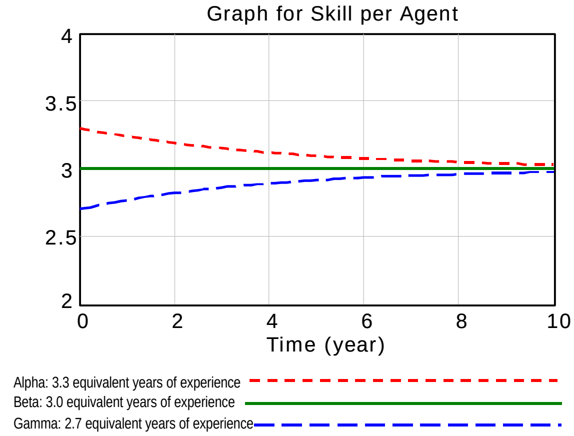
Is the integration of the compensation sub-system and its ensuing additions to the nature of interactions likely to result in a substantially different outcome? Given that this aspect brings into play more reinforcing loops than the previous simulation, one expects a performance profile that could perhaps be 'less stable'. Does this mean that the convergence seen in Simulation 2 will revert back to the steady pattern that was the outcome of Simulation 1 or even beyond? The precise outcome is somewhat difficult to predict by intuition.

Figure 10 shows the complete diagram of the model in use for this simulation. Note the interactions with the previous simulation model are transmitted through the causal links shown by the thick arrows in the diagram. As usual, there are the firms Alpha, Beta and Gamma with their initial details identical to Simulations 1 and 2. Values related to the compensation sub-system have been explained in Appendix 5.

Figure 11 shows the dynamic behavior of the firms for twenty years. The firm Beta repeats a steady performance profile that is linear and flat. As before, the outcome is 3 years in terms of *Skill per Agent* and 75 units in terms of *Profitability*. However, Alpha and Gamma diverge away from the trajectory of Beta, in contrast to the convergence that was observed in Simulation 2. Further, at any point in time, there is a difference among the three firms in the number of *Agent Quits* and *Agents Hired*, but not in the total quantity of *Agents*.

Recall that the initial values of the three firms and the discretionary policies followed in Simulation 3 are the same as in Simulation 2, wherever applicable. To explain the seemingly contradictory behavior we trace the impact of a key variable – *Skill per Agent* –on the newly formed loops. These reinforcing loops have been created by integrating the compensation sub-system with the other loops that existed in the causal structure of the resources prior to this simulation. We follow the case of firm Alpha where the initial value of *Relative Agent Skill* is greater than the steady state value of 1.

FIGURE 8 - Results of Simulation 2



Units: equivalent years of experience (above) and dimensionless (below)

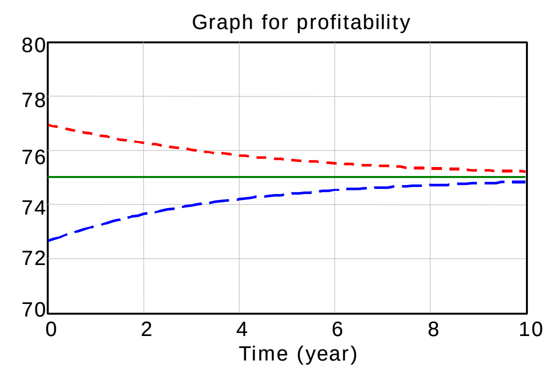


FIGURE 9 - Model for Simulation 2 (extension)

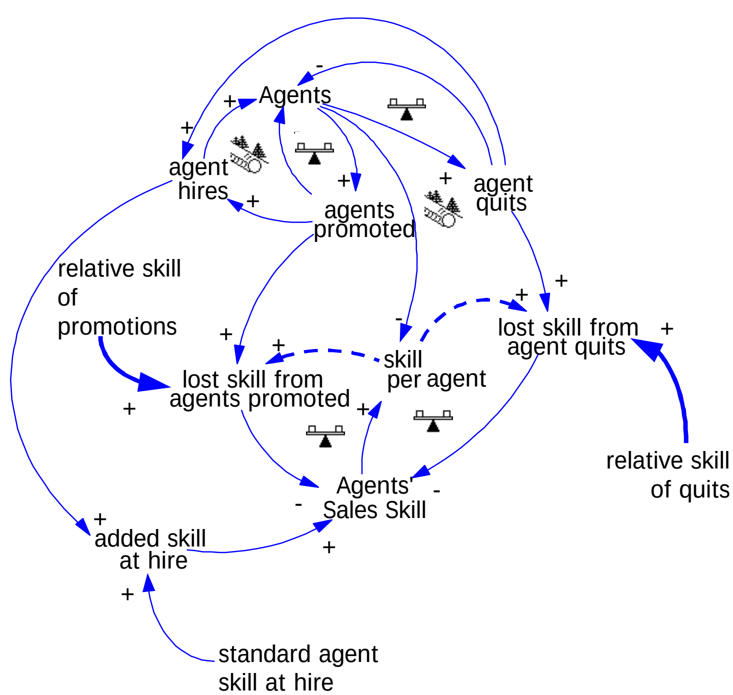


FIGURE 10 - Model for Simulation 3

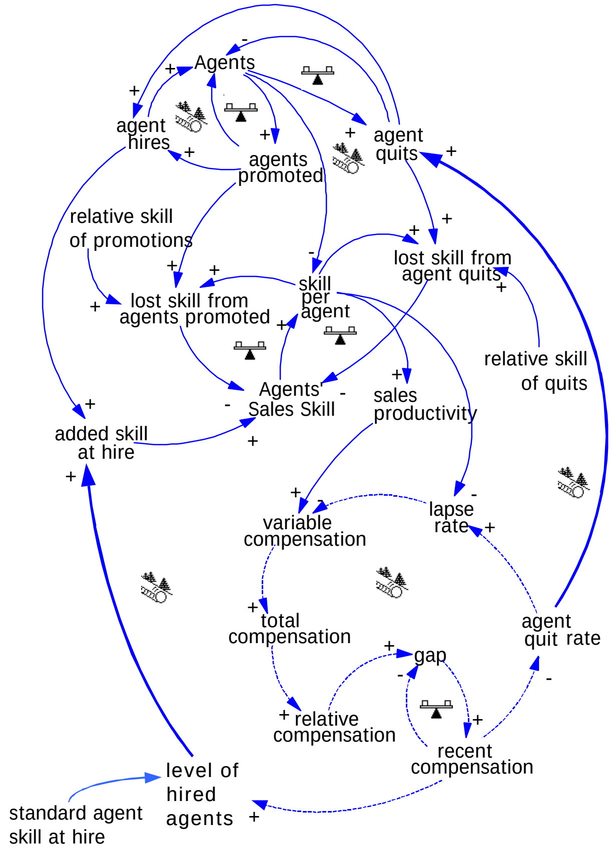
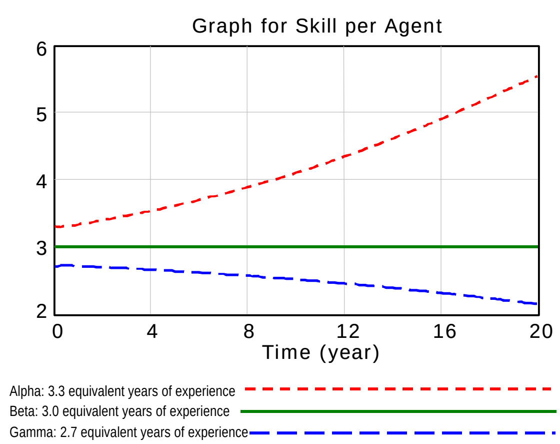
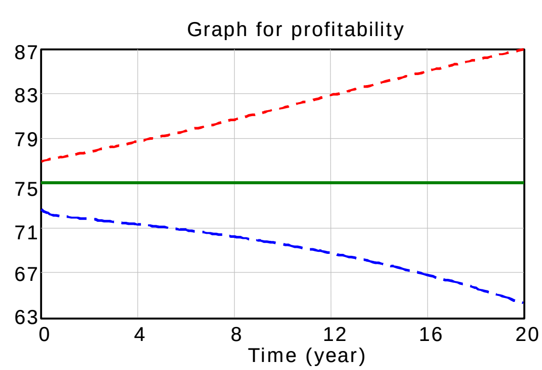


FIGURE 11 - Results of Simulation 3



Units: equivalent years of experience (above) and dimensionless (below)



Appendix 5 demonstrates how an increase in the value of *Relative Agent Skill* beyond its steady state value leads to a decline in the value of *Agent Quit Rate* (with some delay) through a delayed increase in *Recent Relative Compensation*. In the situation of Simulation 3, this becomes an interaction effect – rather, a feedback effect; *Agent Quit Rate* is no longer a constant as it was in Simulation 2, but has now become an indirect function of *Skill per Agent*. If one traces the reinforcing loops from *Skill per Agent* to *Sales Productivity* to the compensation sub-system to *Agent Quit Rate* to the manpower sub-system, the net effect is to increase the accumulation of skills in the stock *Agents' Sales Skill* with respect to the accumulation of *Agents*; each iteration reinforces the relative increase in *Skill per Agent* and *Relative Agent Skill*.

In addition, Appendix 5 demonstrates how the above increase in *Relative Agent Skill* leads to an increase in the value of *Level of Hired Agents*. Again, in this context it becomes a feed-back effect; *Level of Hired Agents* is no longer a constant but an indirect function of *Skill per Agent*. The corresponding reinforcing loops (in Figure 10) are from *Skill per Agent* to *Sales Productivity* to the compensation sub-system to *Level of Hired Agents* to the manpower sub-system. The net effect of each iteration is exactly as spelt out in the previous paragraph.

The accumulation and feedback processes cited in the loops influence the time-evolution of the firms' resources by continuously modifying the existing interaction context. Their combined effect manifests through an accumulation mechanism that opposes and over-compensates the dynamic balance mechanism activated from Simulation 2. The implication is that a firm which has an initial positive displacement of skills with respect to the level required by the market will continue to attract more and more skilled personnel, bringing it more prosperity.

For the firm Gamma, where the initial value of *Relative Agent Skill* is less than the steady state value of 1, the explanation just described works in a symmetrically reverse manner implying steadily decreasing performance. This inherent tendency of the causal structure to move away from the market equilibrium produces the overall divergence effect. The dynamics of reinforcing loops create instability; the context that arises from it demonstrates a decisive impact on differential performance, which results in competitive advantage.

The following, Table 1, summarizes the different simulations and the outcomes.

Simulation	Existing Interactions	New Interactions	Performance Profile	Comments
1	Minor	-	Stable, flat	Heterogeneity sustained
2	As in 1	Lost Skill from Agents Promoted = fn.(Skill per Agent, Relative Skill of Promotions) Lost Skill from Agents Quits = fn.(Skill per Agent, Relative Skill of Quits)	Convergent	Heterogeneity erodes with time
3	As in 2	Agent Quit Rate = fn.(Recent Relative Compensation) Level of Hired Agents = fn.(Recent Relative Compensation)	Divergent	Heterogeneity amplifies with time

DISCUSSION

This section discusses the theoretical implications of the simulation results. So far, the source of heterogeneity in the firms Alpha and Gamma has been taken for granted. There are many ways of arriving at this initial situation – e.g. a difference in policies between firms propagated for some time, even with no other initial heterogeneity. However, it is beyond the scope of this paper to address the dynamics that lead to the initial situation presented here; it is addressed in further research. The lack of managers' response to declining performance in the short and medium term is reviewed here, in light of the sub-systems shown in the model.

In the model, one of the key determinants of performance is *Skill per Agent*. When managers find a decrease in *Skill per Agent*, theoretically they have three kinds of intervention modes: altering the value of *Relative Skill of Promotions* and/or *Relative Skill of Quits*, changing the *Agent Promotion Rate* and intervening in the compensation sub-system. Interviews and accounts from industry experts confirm that managers are too busy in the day-to-day responsibilities of recruiting agents and coaching them, partly because of job requirements and partly because they want to justify the agents they chose. To a large extent, managers effectively find it difficult to monitor the churn rate of agents, let alone consciously monitor the fluctuations and the trajectory of *Skill per Agent*; typically they are ignorant about it until too late. Even if a minority of managers is aware of the situation, there are other difficulties about intervening in the system using this information; these are summarized below.

In the model presented, managers would seek to decrease the values of *Relative Skill of Quits* **and** *Relative Skill of Promotions* to the minimum to improve the average skill level of the agents involved in sales. This implies tracking and analyzing the performance of individual agents. Since it involves a lot of additional effort for managers and requires making biased judgments affecting agents' careers, they would rather go with simple and robust policies that provide greater transparency for all, despite compromising on efficiency. Similarly, managers do not manipulate the compensation sub-system away from standard industry practices for the majority of the agents as per industry norms; they focus attention on retaining outstanding performers through non-financial incentives, though this is not always successful. The ratio of managers to agents is decided and monitored by industry regulators; consequently there is no room for managers to change the value of *Agent Promotion Rate* to their convenience.

The role of the firms Alpha and Gamma in the series of simulations was to control for the nature of initial heterogeneity. Given the systematic changes in resource interactions and corresponding performance profiles, this will assist readers to differentiate between the impact of resource heterogeneity and interaction amongst resources as well as estimate the significance of these factors in the generation and sustenance of competitive advantage.

If the outcome of the first simulation is evaluated in terms of competitive advantage, the firms demonstrate perfect sustainability of their initial competitive advantage / disadvantage. Proponents of RBV e.g. Barney (1986, 1989, 1991), Peteraf (1993) etc. have specified certain properties that resources must possess to ensure the sustenance of competitive advantage. We compare the specified properties with the properties of resources inherent in the simulation.

According to Barney (1991), the resource must be valuable, rare, inimitable and non-substitutable to sustain competitive advantage. Agents with outstanding skills are undoubtedly of value. In the first simulation, they are rare in the sense that they are not regularly recruited from the market, and inimitable as they cannot be developed in-house –

but true to the meaning of initial heterogeneity, they exist at the initial point in time. Together, these imply that the condition of non-substitutability holds. Peteraf (1993) holds that there must be ex-post and ex-ante limits to competition for the critical resource, which must also be superior and imperfectly mobile. The first and the last conditions are satisfied since the agents with outstanding abilities fulfil Ghemawat's ideal of sticky resources (1992). They are superior in performance and available in limited supply, as shown. The condition prescribing limits to ex-ante competition also holds. Since the conditions specified by Barney and Peteraf are met in full, perfect sustainability is predicted, and it follows.

The resource stock *Agents* possesses the characteristics of a resource that is influenced by the interaction of other resources (*Agents Promoted, Agent Quits* and *Agents Hired*). However, in the first simulation, the actual values of these resources are such that no complex behavior is observed. Hence this model serves as a sort of a base to build upon, and with which we could contrast the other simulations.

The firm in the second simulation fails to sustain its initial competitive advantage due to the introduction of a new kind of interaction. The type of interaction that interests us is that the skills of those agents who leave the firm (*Lost Skill from Agent Quits, Lost Skill from Agents Promoted*) are proportional to the instantaneous average skill level (*Skill per Agent*), which is a function of the individual agent's skill, a valuable resource. An examination of the interaction effect on this valuable resource shows that the resource is neither rare nor inimitable, violating Barney's conditions. Similarly, the mobility of agents violates one of Peteraf's requirements. Since some of their specified conditions are not met, the theory predicts non-sustainability of the initial competitive advantage; convergence confirms that.

The nature of this kind of interaction also creates a context that enhances stability. Compared to the first simulation, this new context, despite similar initial heterogeneity, has sufficiently changed the ***dynamics*** of the involved resources to bring about a change in the profile of the firms' performance trajectories. Hence we claim that certain interactions moderate the relationship between resources and performance, through the dynamics of resources.

In the third and last simulation, the performance profile of the firms shows divergence due to interaction with the compensation sub-system. Management persists with the policies that brought convergence in the second simulation. Their interactions continue to violate the requirements specified by Barney and Peteraf. However, these interactions are now enmeshed in another kind of interaction-driven context that ***reverses the direction of mobility*** of the valuable resource pointed out above; instead of convergence this leads to the observed divergence and differential performance. From a dynamic point of view, it seems the conditions that resources must fulfil to sustain competitive advantage are *over-specified*. There arises the distinct possibility that competitive advantage, which results from differential performance, might be created from a suitable combination of ordinary resources without satisfying all the conditions laid out by Barney or Peteraf.

From the perspective of causal structure, interactions with the compensation sub-system simply means that the flow of resources to the stock *Agent Sales Skill* has put that stock into an accumulation mode that orients it towards instability rather than stability. The context arising from this has overhauled the *dynamics* of the involved resources to reverse the profile of performance trajectories.

With respect to Simulation 1, Simulations 2 and 3 have shown how resource interactions can bring about complex behaviors, demonstrating the creation of competitive advantage through dynamic complexity. The contrast between Simulation 2 and Simulation 3 shows that while resource heterogeneity may be a necessary condition for differential performance, it is the *nature of interactions* that determine how far the heterogeneity will continue. The outcome of the last simulation provides support for our claim that the nature of interactions is a key ingredient in creating the context for the interaction of resources that moderates the relationship between resources and performance, through the dynamics of resources.

CONCLUSION

Having demonstrated and discussed the objectives that were set for this paper, this section attends to some related issues for research and their implications for managers in enhancing competitive advantage for their organizations. One of the important characteristics of the method used is the disaggregation of resource relationships and the specification of processes; researchers following the frameworks of Rouse & Daellenbach (1999) and Noda & Collis (2001) can go beyond producing a case-study to provide managers with levers and mechanisms that might enhance success in past and future environments. In addition, managers can quantitatively examine the range of operational freedom that these levers and mechanisms provide, apart from being able to compare their relative ease of use and the speed and consequences of their impact.

Further, the method answers Bromiley’s call (1993) for a better operationalization of the propositions of the resource-based view, in a manner such that it can better overcome the charge of tautology (Priem & Butler, 2001). By specifying causal linkages with intermediate variables, it provides synthetic instead of analytic statements (Powell, 2001) that facilitates examination of the propositions of the resource-based view in a more exacting manner.

The method may not always help pinpoint the singular source of competitive advantage. However, if managers are convinced that the manner of combining resources is important and can be a source of competitive advantage in its own right, then the method does facilitate the identification of those critical resource stock accumulations that are vital for competitive success. Based on this, managers can derive actionable implications to attain competitive advantage for diverse circumstances. Exploring the consequences of proposed actions through a simulation helps to arrive at policies that may be more robust. Further, it can be used to accurately identify – even quantify – the relative contributions of the various sources of differential performance (e.g. initial heterogeneity, interactions among resources) when one examines how initial heterogeneity is propagated through time.

From Simulation 2, one might infer that the endowment of resources, or the initial position, makes no difference or plays no role in the ultimate outcome. In contrast, Simulation 3 shows that the initial position makes a critical difference in the ultimate outcome. This shows that the importance of certain resources (in this case, *Skill per Agent*) can diminish or increase with respect to time. Moreover, what was a resource with little influence on performance in Simulation 2 has become of critical importance in Simulation 3 – implying that the importance of resources can change with the policies being followed by management and the context allowed for the time-evolution of resources. This conclusion suggests that more attention should be paid to the role of path dependence in creating value for organizations.

According to the resource-based view, mobility of resources is an important factor for competitive advantage. Peteraf (1993) takes a protective view of mobility: for her, immobility is the way to go. She implies that firm-specific investment and co-specialized assets retard the mobility of superior resources; managers can thus increase rent appropriation and sustain their competitive advantage. In contrast, the analysis of Simulation 3 established that the mobility of resources, in the right direction, is critical to the generation of competitive advantage. Managers need to think in terms of *comparative mobility* of resources; as long as the number and quality of resources entering the firm are more useful than those leaving the firm, accumulation will ensure that the relevant resource-stocks build up, over time.

This idea also has a parallel with respect to competitors: managers need to ensure that the quantity and quality of resources entering their firm is better than those being acquired by the competition to increase their competitive advantage. The hint is that managers could be more outward oriented and think like entrepreneurs: those continuing to attract the best net quality of resources will generate higher revenue or lower cost than their competition and would therefore improve the performance and profitability of their firm relative to their competitors.

These simulations also provide evidence that bringing in the appropriate kind of dynamic complexity can create value. Earlier in this paper, we looked at some other papers that study the impact of detail complexity on performance. A comparison of the two modes of value creation shows up two contrasts. First, detail complexity may protect valuable resources from being copied because the details are opaque or myriad to competitors while dynamic complexity relies on the probability that a small difference in initial conditions and/or interactions can open up large gaps in performance, over time.

Second, due to the linkages between the many details, organizations employing detail complexity have to compromise on flexibility. Dynamic complexity provides flexibility because policies can be changed quickly, according to necessity. The implication for senior management is that in an active environment that prizes flexibility, organizations relying on dynamic complexity may have a significant advantage over those relying on the other kind. The facility to use dynamic complexity is thus an example of superior management.

References:

Amit R.H. and P.J.H.Schoemaker (1993). 'Strategic assets and organizational rent', *Strategic Management Journal*, **14**(1), pp. 33-46.

Arthur, W.B. (1989). 'Competing technologies, increasing returns and lock-in by historical events', *Economic Journal*, **99**, pp. 116-131.

Arthur, W.B. (1990). 'Positive feed-backs in the economy', *Scientific American*, pp. 92-99.

Barney, J.B. (1986). 'Strategic factor markets: Expectations, luck, and business strategy', *Management Science*, **32**(10), pp. 1231-1241.

Barney, J.B. (1989). 'Asset stocks and sustained competitive advantage: A comment', *Management Science*, **35**(12), pp. 1511-1513.

Barney, J.B. (1991). 'Firm resources and sustained competitive advantage', *Journal of Management*, **17**(1), pp. 99-120.

Barney, J.B. and E.Zajac (1994). 'Competitive organizational behavior: Toward an organizationally-based theory of competitive advantage', *Strategic Management Journal*, **15** (Winter Special Issue), pp. 5-9.

Black, J.A. and K.B.Boal (1994). 'Strategic resources: Traits, configurations and paths to sustainable competitive advantage', *Strategic Management Journal*, **15**(1), pp. 131-148.

Collis, D.J. and C.A.Montgomery (1995). 'Competing on resources: Strategy in the 1990s', *Harvard Business Review*; **73**(4), pp. 118-128.

Collis, D.J. (1994). 'How valuable are organizational capabilities?', *Strategic Management Journal*, **15** (Winter Special Issue), pp. 143-152.

Cyert, R. and J.March (1963). *A Behavioral Theory of the Firm.* Harvard University Press, Prentice-Hall, Englewood Cliffs, NJ.
DeCarolis, D.M. and D.L.Deeds (1999). 'The impact of stocks and flows of organizational knowledge on firm performance:', *Strategic Management Journal*, **20**(10), pp. 953-968.
Dierickx I. and K.Cool (1989). 'Asset stock accumulation and the sustainability of competitive advantage', *Management Science*, **35**(2), pp. 1504-1511.
Forrester, J.W. (1961). *Industrial Dynamics*. Pegasus Communications, Waltham, MA.
Grant, R.M. (1991). 'The resource-based theory of competitive advantage: Implications for strategy formulation', *California Management Review*, Spring 1991, pp. 114-135.
Hamel, G. and C.K.Prahalad (1990). 'The core competence of the corporation', *Harvard Business Review*, **68**(3), pp. 79-91.
Levinthal, D.A. (1997). 'Adaptation on rugged landscapes', *Management Science*, **43**(7), pp. 934-950.
Levinthal, D.A. and J.Myatt (1994). 'Co-evolution of capabilities and industry: The evolution of mutual fund processing', *Strategic Management Journal*, **15**(1), pp. 45-62.
Lippman, S. A. and R.P.Rumelt (1982). 'Uncertain imitability: An analysis of interfirm differences in efficiency under competition', *Bell Journal of Economics*, **13**, pp. 418-453.
Mahoney, J.T. and J.R.Pandian (1992). 'The resource-based view within the conversation of strategic management', *Strategic Management Journal*, **13**(5), pp. 363-380.
Malerba, F., R.Nelson, L. Orsenigo and S.Winter (1999). 'History friendly models of evolution:', *International Journal of Industrial Organization*, **19**, pp. 635-664.
Malerba, F., R.Nelson, L.Orsenigo and S.Winter (2001). 'Competition and industrial policies in a history friendly model of the ….', *Industrial and Corporate Change*, **8**(1), pp. 3-41.
Mason, R.O. (1969). 'A dialectical approach to strategic planning', *Management Science*, **15**(8), pp. B403-B414.
Miller, D. and J.Shamsie (1996). 'The resource-based view of the firm in two environments:', *Academy of Management Journal*, **39**(3), pp. 519-543.
Mitroff, I.T., R.O.Mason and V.P.Barabba (1982). 'Policy as argument – A logic for ill-structured decision problems', *Management Science*, **28**(12), pp. 1391-1404.
Morecroft, J.D.W. (1984). 'Strategy support models', *Strategic Management Journal*, **5**(3), pp. 215-229.
Morecroft, J.D.W. (1985). 'Rationality in the analysis of behavioral simulation models', *Management Science*, **31**(7), pp. 900-916.
Morecroft, J.D.W. (1994). 'Executive knowledge, models and learning'. In J.D.W. Morecroft and J.D. Sterman (eds.) *Modeling for Learning Organizations.* Productivity Press, Portland, OR, pp. 3-28.
Morecroft, J.D.W. (2000). 'Resource management under dynamic complexity'. In J.D.W. Morecroft, A. Heene and R. Sanchez (eds.) *A Systems View of Resources, Capabilities and Management Processes.*
Nelson, R. and S.Winter (1982). *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, MA.
Noda, T. and D.J.Collis (2001). 'The evolution of intraindustry firm heterogeneity: Insights from a process study', *Academy of Management Journal*, **44**(4), pp. 897-925.
Penrose, E.T. (1959). *The Theory of the Growth of the Firm*. Oxford University Press Inc., New York, NY.
Peteraf, M.A. (1993). 'The cornerstones of competitive advantage: A resource-based view', *Strategic Management Journal*, **14**(3), pp. 179-191.
Porter, M.E. (1991). 'Toward a dynamic theory of strategy', *Strategic Management Journal*, **12** (Winter Special Issue), pp. 95-117.
Powell, T.C. (2001). 'Competitive advantage: Logical and philosophical considerations', *Strategic Management Journal*, **22**(9), pp. 875-888.
Priem, R.L. and J.E.Butler (2001). 'Tautology in the resource-based and the implications of externally determined resource value:', *Academy of Management Review*, **26**(1), pp. 57-66.
Prahalad, C.K. and R.A.Bettis (1986). 'The dominant logic: A new linkage between diversity and performance', *Strategic Management Journal*, **7**(6), pp. 485-501.
Riegel, R. and J.S.Miller (1966). *Insurance Principles and Practices.* Englewood Cliffs: Prentice-Hall, Upper Saddle River, NJ.
Rivkin, Jan W. (2000). 'Imitation of complex strategies', *Management Science*, **46**(6), pp. 824-864.
Rouse, M.J. and U.S.Daellenbach (1999). 'Rethinking research methods for the resource-based perspective:', *Strategic Management Journal*, **20**(5), pp. 487-494.
Rumelt, R.P. (1984). 'Toward a strategic theory of the firm'. In R. Lamb (ed.) *Competitive Strategic Management*. Prentice-Hall, Englewood Cliffs, NJ, pp.556-570.
Sterman, J.D. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Irwin/McGraw Hill, New York, NY.
Wernerfelt, B. (1984). 'A resource-based view of the firm', *Strategic Management Journal*, **5**(2), pp. 171-180.

APPENDIX 1

Background of the Insurance Industry & Description of its Activities

The beginnings of the modern life insurance industry can be traced back to the 16th century as the earliest recorded policy was sold in 1583 in England. Since then life insurance has become an international social institution. The aim of the industry is to help combine the risks from a large number of individuals to reduce the degree of uncertainty. These individuals agree to make small contributions in order to reimburse those who suffer from events insured against. Thus the scope of the life insurance industry is to enable persons avoid the ***financial consequences*** of risks or uncertain events (Riegel and Miller, 1966).

A typical British insurance firm sells "policies" (insurance contracts) to those who want to insure themselves. These insurance contracts are the "products of the firm. Policyholders usually pay relatively small annual "premiums" and make claims with the insurance company if and when they suffer losses covered by their policies. In the meantime, the insurance firm is supposed to invest and grow the funds that accrue to them in order to keeping them secure, meet pay-out needs and return funds to mature policy-holders as and when necessary.

Major players have a common set of tasks – selling insurance contracts, selecting risks, fixing and collecting premiums, writing policies, investing money, keeping accounts, collecting, researching and analyzing statistics, processing claims and dealing with legal issues and cases. These tasks are executed either by building the required skills as individual firms, or sharing them from a common pool – depending upon the quantum of required investment and the scope for differentiation. Given that new types of offerings can easily be copied, it is really difficult to establish a sustained differentiation with respect to competitors. Collecting, researching and analyzing statistics is a pooled activity, due to economies of scale.

The claims department (a cost center) is responsible for processing claims and the legal issues involved therein. The scope to differentiate here is limited[12]. The investment department (a profit center) invests the incoming premiums. Some countries require the financial performance of investments be legally kept apart from rest of the organization. This brings us to the remaining activity – the selling of insurance contracts. Demand can be generated through push (sales) and pull (marketing). But the scope for differentiation through marketing is limited, as it is difficult to compete on prices and very difficult to sell differentiated products (contracts) on a sustained basis. Thus only a relatively small amount of funds are put aside for marketing campaigns compared to the funds put aside for the agency department, which handles sales agents. These departments are shown in Figure 12.

There exist different kinds of agency systems in the insurance industry – e.g. the general agency and branch office systems in life insurance, the independent agency and exclusive agency systems in property and casualty insurance. Common to agency systems is the practice of selling policies through agents who receive a commission for the sale of these contracts. They differ in the degree of control that the management of the firm exercises over its agents and their compensation structure. Agents are responsible for minimizing 'lapses' in the policies they sell. A 'lapse' occurs when the client discontinues payment of premiums towards an insurance contract before the contract permits.

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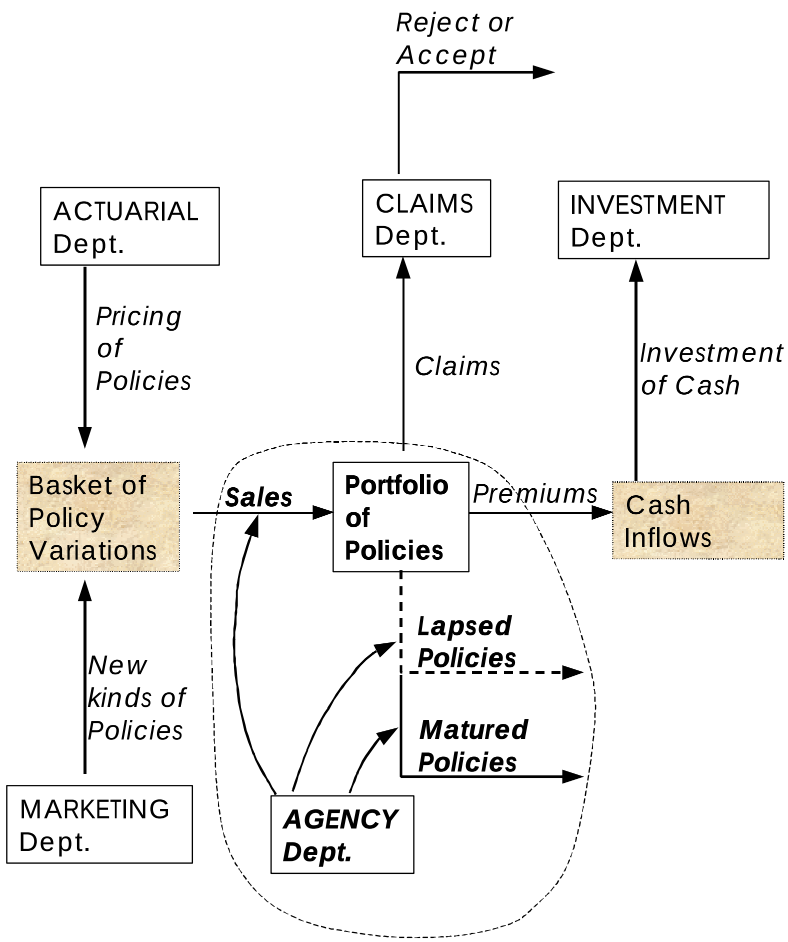
[12] No firm would want to establish either a reputation for compromising on payments or take a hit on its profitability by relaxing payment standards.

FIGURE 12 - An Insurance Firm



APPENDIX 2

Measures of Profitability in the Insurance Industry

Insurance industries have their own particular measures of profitability. The measure of new business profitability is an efficiency measure called New Business Expense Ratio (NBER) and is defined as:

$$NBER = \frac{\text{Expenses Incurred for Obtaining New Business x 100}}{\text{New Business Annual Premiums}}$$

Another measure of profitability concerned with the efficiency of renewing policies is called the Renewal Expense Ratio (RER). It is defined as:

$$RER = \frac{\text{(Total Expenses – Expenses Incurred for Obtaining New Business)}}{\text{(Total Premiums – New Business Premiums) / 100}}$$

APPENDIX 3

Activities in a Typical Agency Department

We focus on the agency department of large firms in the insurance industry and will henceforth refer to the stylized department as a firm. The firm competes to sell policies to those who want to buy insurance. These products provide the insurance firm with premiums for the length of the life of the product, if they do not 'lapse'. The larger the product base (i.e. the inventory of live policies sold by the firm), the larger the cash flow and revenue to the insurance firm. These sales are actually in a cycle of three stages. In the first stage, agents are recruited from the market to be employees of the firm and become part of the agent body that goes out to sell policies to prospective customers in the market. Firms always seek to hire more experienced agents from the market and to retain the better-performing agents. In the second stage, policy sales accumulate as the body of policies in force and form the basis of the future revenue stream (as premiums) unless these policies lapse. Policy sales and lapses are a function of the skill level of the agents. In the third stage, agents are compensated based on the sales made and lapses occurred in that particular year.

When agents join the firm, they not only increase the headcount of sales employees but also add their sales skills to the skill pool of the firm. Also, from time to time, some agents quit the firm and some are promoted. These decrease the headcount of the sales employees as well as from the aggregate skill pool of the firm. While agents quitting the firm tend to have lower than the average skill level, those promoted will have a higher than average skill level. Thus it is a challenge to the management to maintain and improve upon the skill level of their agent base. Agent compensation is of particular importance. If the agents perform above the performance level expected by the market, the compensation that results is also above market expectations. Conversely, performance inferior to market expectations leads to inferior compensation. In turn, compensation affects the quit rate of agents (the quit rate influences the lapse rate of new policies sold) as well as the attractiveness of the firm to new agents who are considering whether to join the firm.

We use a measure of performance that reflects the costs and benefits of net new business acquired and which is closely related to the measure of new business expense ratio described in Appendix 2. It is defined as the ratio of net new products to the expenses incurred in selling these policies. We ignore products that mature because they are a function of the firm's existing portfolio of products and therefore, an indication of the past performance of the sales force. Hence,

$$\text{Profitability} = \frac{\text{Number of products sold} - \text{Number of products lapsed}}{\text{Total expenses of selling products}}$$

As our focus is on the agency department, we use the quantum of new products sold per year in lieu of the premiums earned annually due to new business. As we assume products of standard length and premium, the only dimension of distinction in sales is the number of products sold. Hence, larger the number of contracts the firm can sell (that do not lapse), per unit labor cost, the greater the profitability of the firm.

APPENDIX 4

Headcount subsystem

Figure 13 shows the processes directly concerned with the management of agent headcount, using system dynamics diagram symbols. The number of agents in the firm (*Agents*) is a tangible resource-stock that is affected by the flows of agents who quit, who are promoted and who are hired. This flow of agents who quit (*Agent Quits*) is a function of the (*Standard*) *Agent Quit Rate* and is also directly proportional to the number of agents in the firm. Agents may quit because of a variety of reasons: boredom, better opportunities, unsatisfactory compensation / unsatisfactory performance, etc. These factors have a clear impact – changes in the factors can increase or decrease *Agent Quit Rate*. We'll explore these factors in more detail later. Similarly, the resource-stock *Agents* also decrease because of the flow of promotions granted by management (*Agents Promoted*). Agents are promoted to managers. Managers have other responsibilities besides selling policies but at this moment we will assume that managers are external to the system. The number of managers required (and hence the rate of agents promoted) will be proportional to the number of agents that exist in the firm. We also assume that a fixed proportion of agents is promoted (*Promotion Rate*).

Agents lost due to quits and promotions have to be replenished. The process of hiring does this. The absence of hiring would result in a continuous decrease in the number of agents available for sales. Hence the rate of agents to be recruited (*Hires*) is determined by the number of agents who quit and who are promoted. As long as this equation holds, there is no net increase or decrease in the number of agents available to the firm and steady state conditions prevail. It is relatively easy to maintain headcount because of the ease of counting persons and then set a target to hire the required number. The number of agents quitting the firm, the number of agents being promoted as well as the number of agents itself have an important impact in accounting for the dynamics of the skill subsystem of the firm, which we explore in detail next.

Skill Subsystem

This subsystem models the dynamics of the agents' skills. Figure 14 shows the processes directly concerned with the management of agent skills, which is an intangible resource for the firm. All the agents in the firm have some intrinsic sales skill (measured in terms of equivalent years of experience) and the aggregate skill among the agents is accounted by the stock *Agents' Sales Skill* (the skill pool of the firm). From this skill pool and the number of agents, we can work out the average skill level of the firm's agents (*Skill per Agent*). This measure of ability has an important impact on sales and other functions of the firm.

When agents quit the firm, they carry away their skill. The skill lost (*Lost Skill from Quits*) depletes the skill pool of the firm. Apart from being a function of *Agent Quits*, *Lost Skill from Quits* depends also on the *Relative Skill of Quits*. The ideal objective of managers is to let this relative skill reflect the average skill level of the market, provided they can retain their superstars. In reality, however, it is likely to be managed as a simple function or proportion of the existing skill in the firm (*Skill per Agent*). If so, this number would be less than one as we expect the agents performing worse than the firm average to be prompted to leave (known in industry parlance as 'culling'). Keeping this policy simple benefits both management and the agent-employees. For management, it reduces some uncertainty about the amount of skills they expect to lose and reduces the extra effort implied in implementing a policy that varies in accordance with other phenomena in the firm. A simple policy provides greater transparency for agents as well as job-security for those agents performing above average.

When agents are promoted, the skill pool is similarly depleted by *Lost Skill from Promotion*. As expected, *Lost Skill from Promotion* depends on *Agents Promoted* and the *Relative Skill of Promoted Agents*, which we assume to be a simple ratio: in reality it is proportional to the existing skill in the firm or to be a constant. If the ratio is in terms of *Skill per Agent*, it would be greater than one as we expect only those agents who are better than average to be promoted. Once again, a simple policy here benefits both management and agents in the manner outlined immediately above.

Agent skills lost due to quits and promotions also have to be replenished. This is done from through the skills of those hired (*Added Skill at Hire*). The absence of hiring would result in a continuous decrease in the skill base of the firm. The added skill is a function not only of the number of agents hired but also of the average skill level of the agents hired (*Agent Skill at Hire*). This skill is determined by two influences. The first is *Standard Agent Skill at Hire*, which basically reflects the market conditions about the skill of agents available for hire to all firms in the industry. Rarely can one expect this market average to be above the average market skill level – as above average agents are easily hired away by other firms too. The second influence is the effect of compensation on recruited skill (for the firm in question). The overall effect of this is to move the actual average skill

FIGURE 13 - Headcount Subsystem

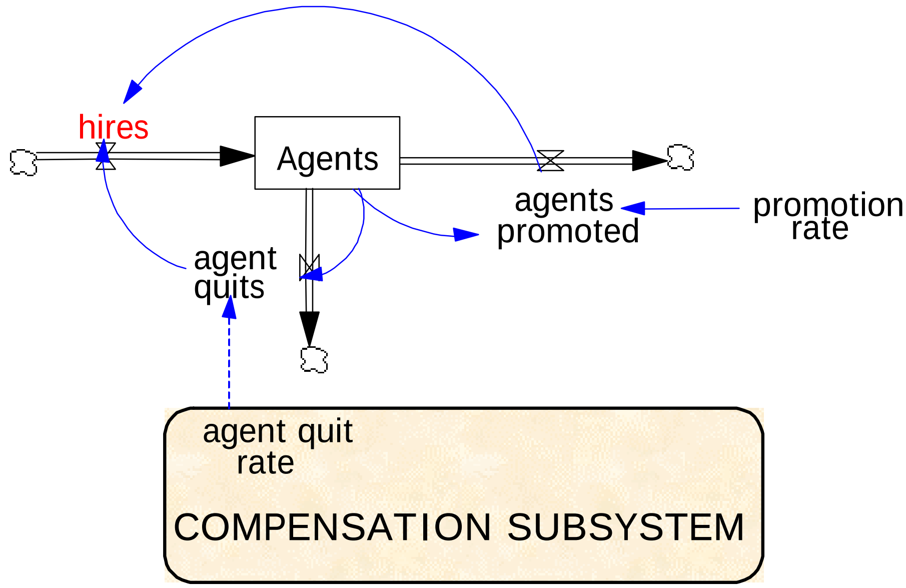


FIGURE 14 - Skill Subsystem

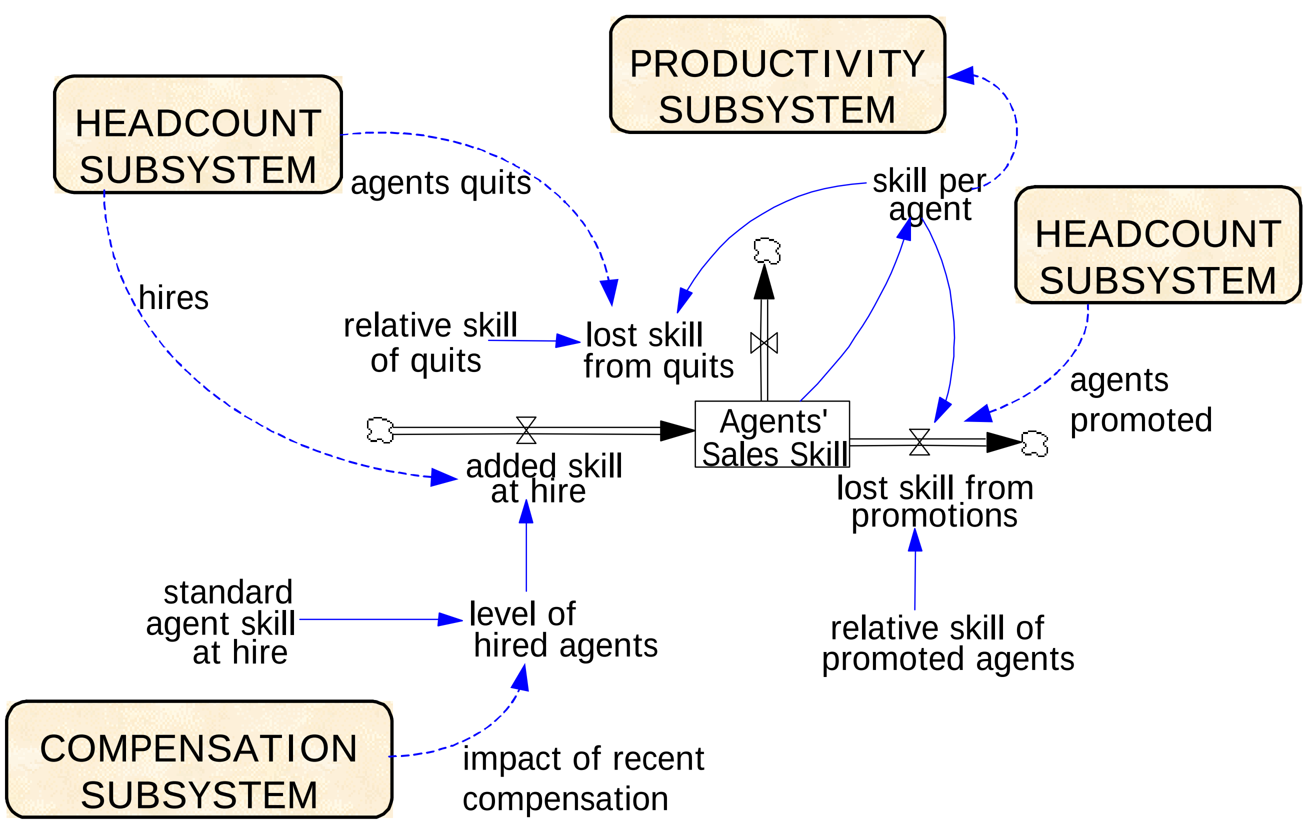


FIGURE 15 - Productivity Subsystem

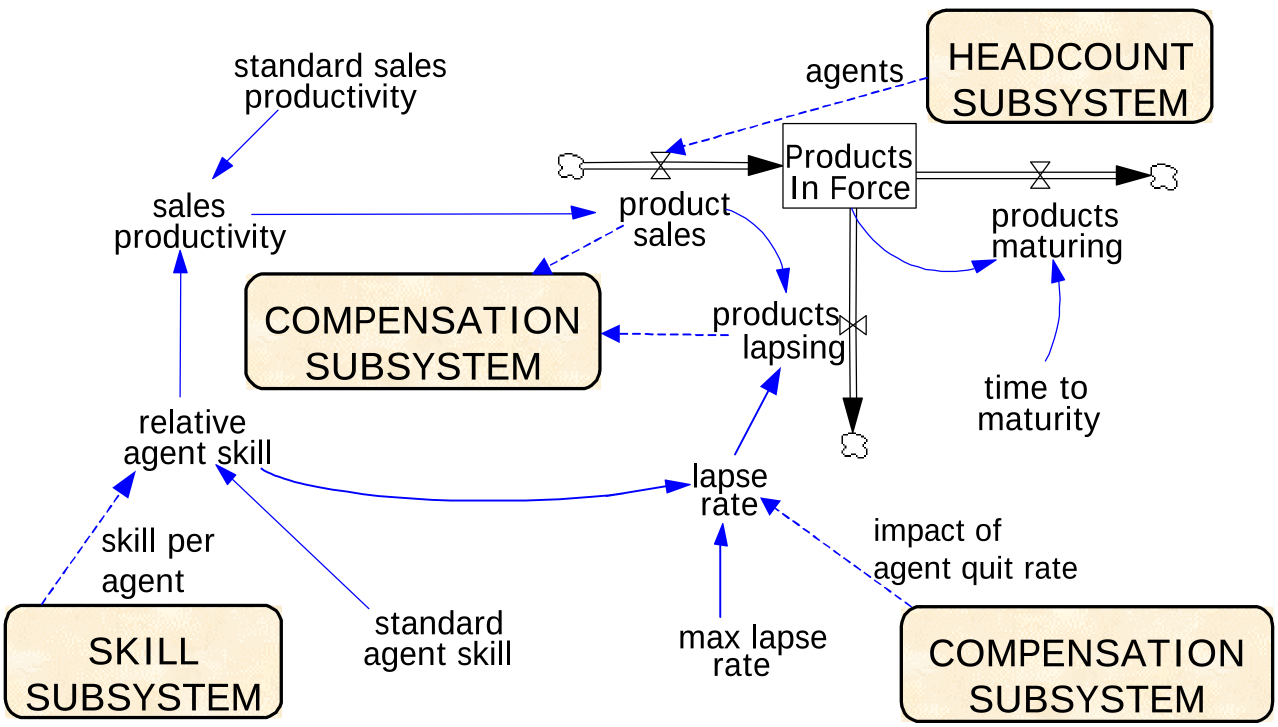
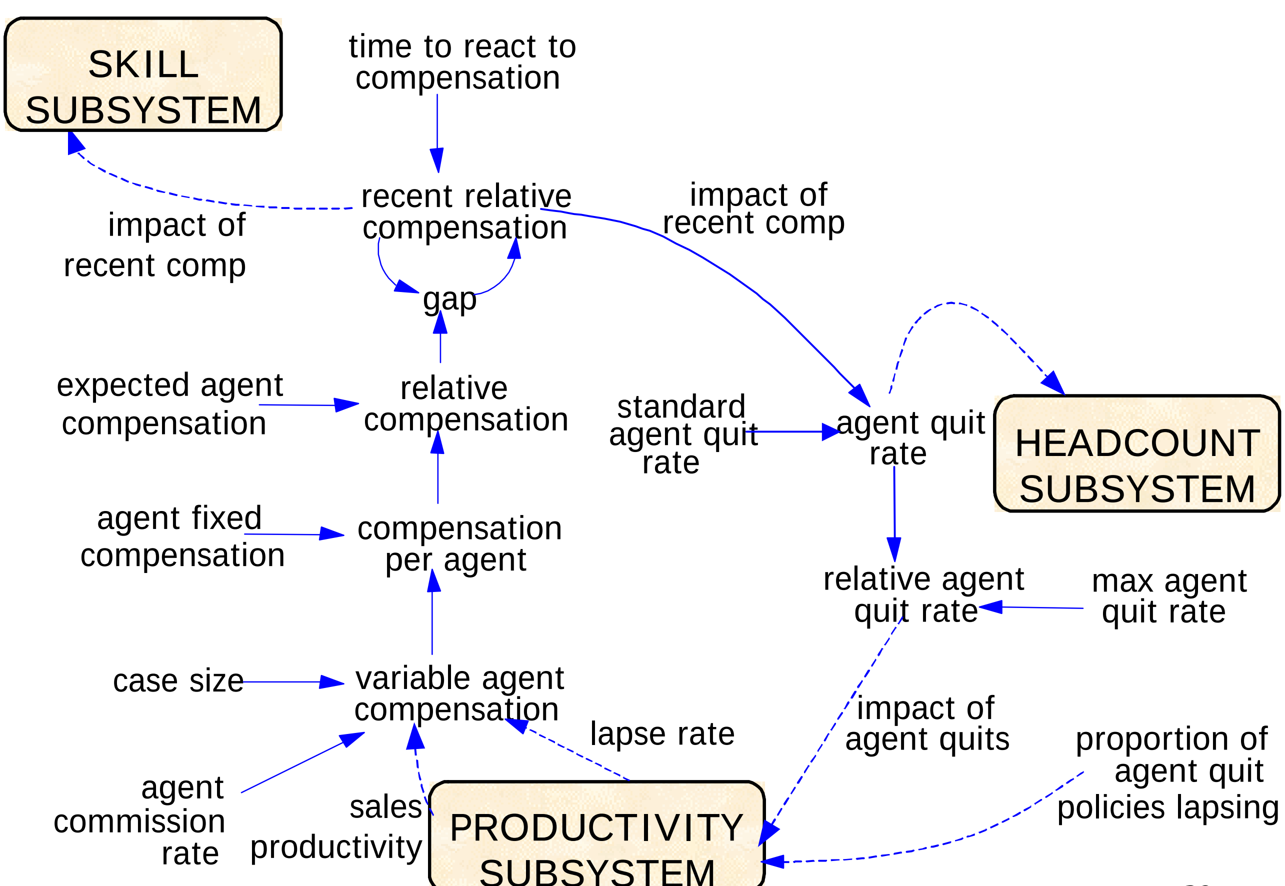


FIGURE 16 - Compensation Subsystem



of the agent hired up and down in accordance with the average relative compensation (relative to market expectations). We will explore this in detail in a later subsystem.

Taken together, these inflows and outflows of skills represent a significant challenge to management trying to preserve and grow the skill base of the firm. It is difficult to measure something more intangible like the skill associated with each agent who leaves, and more so to set a target based on those who enter the skill pool – since it is tricky to recognize and induce ***only*** the most talented to join the firm. Since the rate at which agents quit and the subsequent rates at which agents have to be hired are likely to fluctuate and vary with time, management would find it more practical to manage this balance with simple and robust policies that reduce their effort and provide greater transparency to all.

Productivity Subsystem

This subsystem elaborates on the productivity of the sales agents and the resultant dynamic impact on the product portfolio. Figure 15 sketches the relevant process details. *Skill per Agent* from the previous subsystem determines *Relative Agent Skill* which is basically a ratio of *Skill per Agent* to the prevailing expected average market standard skill of sales agents, *Standard Agent Skill*. In turn, *Relative Agent Skill* determines *Sales Productivity*, which is a product of *Relative Agent Skill* and *Standard Sales Productivity*, the productivity of the average sales agent in the industry in terms of policies sold per year. From here, *Product Sales* is simply the product of *Sales Productivity* and *Agents*, from the headcount subsystem and indicates the number of policies added (in a given amount of time)to the existing portfolio of policies, *Products in Force*. More sales imply an increase in the number of *Products in Force*, which is a tangible resource of the firm. The number of *Products in Force* may also decrease, because of two different effects. The first effect is a sort of expected, natural decay as policies mature (*Products Maturing*) and premiums for those policies stop coming in. The fraction of *Products in Force* that matures is inversely proportional to *Time to Maturity*, which we assume to be a constant in our simplified model. The second effect that decreases *Products in Force* is due to *Products Lapsing*. Since most lapses are likely to occur in the very early life of the policy, it can be estimated to be proportional to *Product Sales* (not *Products in Force*) and the *Lapse Rate*.

As mentioned earlier, a policy lapses when the customer stops paying the requisite premium for the policy on time. This phenomenon may be exacerbated if the customer discovers that he has been sold a policy that is not the best for his needs. In other words, it is a function of the skill of the agent to listen to the customer and draw out his needs – a skill that can be estimated by the experience that an agent has. In the model, *Lapse Rate* can initially be assumed to be a function of *Maximum Lapse Rate* (a constant) and *Relative Agent Skill*. Simply put, an increase in the *Relative Agent Skill* means that the agents are more skilled than market expectations and the *Lapse Rate* drops as a result. Conversely, a decrease in the *Relative Agent Skill* implies that the agents are less skilled than market expectations and the *Lapse Rate* increases. In all these three flows that affect the accumulation of *Products in Force*, there are really very few direct levers for management to influence.

Compensation Subsystem

This subsystem models the mechanics of compensation for agents and outlines its impact on the other three subsystems. Figure 16 shows how compensation is influenced by *Sales Productivity* and *Lapse Rate* from the productivity subsystem, and through what variables it can influence the other three subsystems. Meanwhile the important variables in this subsystem are *Variable Agent Compensation*, *Relative Agent Compensation*, *Recent Relative Compensation* and *Agent Quit Rate*. Before we go on to understand the intricacies of agent compensation, it is useful to remind readers that in our simplified model the only aspect through which a sales agent can distinguish himself is by making more sales, as we have assumed uniform products (insurance policies). Uniform policy length and uniform premiums follow from this assumption. The total compensation per agent (*Total Agent Compensation*) is the sum of two types of compensation – variable (*Variable Agent Compensation*) and fixed (*Fixed Agent Compensation*). *Variable Agent Compensation* is determined by four (multiplicative) factors. The first factor is obviously the average productivity of the agents, *Sales Productivity*. The second and the third are the size of the premium (*Case Size*) and the *Agent Commission Rate*. While *Case Size* is assumed to be a constant, managers would prefer to follow the industry standard of paying the agent 100% of the commission collected from a policy in the first year of the sale (if it does not lapse). The last factor is the complement of the *Lapse Rate* (i.e. 1.0 – *Lapse Rate*), as the agent will be paid commission only for the policies that do not lapse. *Fixed Agent Compensation* is a relatively small component of the total expected compensation (about 25%), paid by management at the level of the industry standard and does not need to change out of step with the industry.

Given what other agents are earning in other firms on average (*Expected Agent Compensation*), a relative compensation (*Relative Agent Compensation*) can be calculated that is the ratio of *Total Agent Compensation* to *Expected Agent Compensation*. One might expect that agents decide on whether they want to stay on, quit or join based on this variable, but in reality, agents prefer to wait and watch a little, partly in the hope that things may change for the better and partly to be sure that they are indeed getting a good/bad deal from the firm. In practice, it requires about three months to crystallize expectations. Effectively this implies that the agents tend to act on the compensation status three months previous to the current date. The actual variable that motivates the action of the agents is called *Recent Relative Compensation*.

Let us now examine in detail how *Recent Relative Compensation* impacts the variables in the other subsystems, viz. *Agent Skill at Hire* and *Agent Quit Rate* – to get an idea of the overall impact to the system brought about by the dynamics of this key variable. Recall that the second component of *Agent Skill at Hire* was the effect of compensation on recruited skill. When *Recent Relative Compensation* is equal to 1, (i.e. average compensation is as expected by the industry benchmark) agents perceive themselves to be no better off by joining, it has no effect on the variable in question. Agents that interview with the firm are indifferent towards the firm, as they perceive it to be neither better nor worse off than competition. When *Recent Relative Compensation* is greater than 1, implying superior average compensation, the overall effect is one of positive reinforcement. Agents being recruited will now expect to earn above average and the better agents will try to beat out those with lower skills and attempt to enter the firm. This, in turn, implies an increased value of *Agent Skill at Hire* because it is a product of *Standard Agent Skill at Hire* and the effect, which is now positive (i.e. > 1). In the same manner, when *Recent Relative Compensation* falls below 1, the better agents shun the firm because of lower expectations. The reinforcement effect turns negative when its value falls below 1 and has a deleterious effect on *Agent Skill at Hire*.

Just as *Added Skill at Hire* is composed of two factors – *Standard Agent Skill at Hire* and the effect of compensation on *Agent Skill at Hire*, *Agent Quit Rate* may also be seen to share the same structure. In this case it would be the product of the invariant *Standard Agent Quit Rate* and the effect of compensation on the quit rate. *Recent Relative Compensation* has a similar impact on *Agent Quit Rate*, but in a nominally opposite direction. When it climbs beyond 1, agents in the firm want to enjoy the good times (i.e. compensation above industry average) and are reluctant to leave the firm – as a result of which the effect of compensation on the quit rate falls below 1, and with it falls *Agent Quit Rate*. Similarly, when *Recent Relative Compensation* falls below 1, agents are keen to seek out opportunities elsewhere: consequently *Agent Quit Rate* rises above the value of *Standard Agent Quit Rate*. There is also the cascading effect of *Agent Quit Rate* on *Lapse Rate*. An increased *Agent Quit Rate* implies higher agent turnover, and in many cases, agents that leave the firm may convince their customer to pay the premium to their new employer instead of the old one. As a result the *Lapse Rate* for the old employer increases. Similarly, a drop in the *Agent Quit Rate* implies a drop in the *Lapse Rate* as well. We have seen earlier that all these three variables – *Agent Skill at Hire*, *Agent Quit Rate* and *Lapse Rate* impact different parts of the system in turn and the overall dynamic impact of a shift in *Recent Relative Compensation* away from the stable value of 1 is not so easy to predict. However, it is pointed out that as in the previous subsystem, there are again very few levers for management to play around with on a long-term or medium-term basis. For example, reducing the fixed salary or commission will bring about unfavorable comparisons with the rest of the industry while increasing these commissions for all agents are hard to justify because of increased expenses.

Profitability: The calculation of *Profitability* is relatively simple. It is simply the difference between *Product Sales* and *Products Lapsing*, divided by *Total Agent Compensation*.

APPENDIX 5

Exploring the Dynamics of the Compensation Sub-system

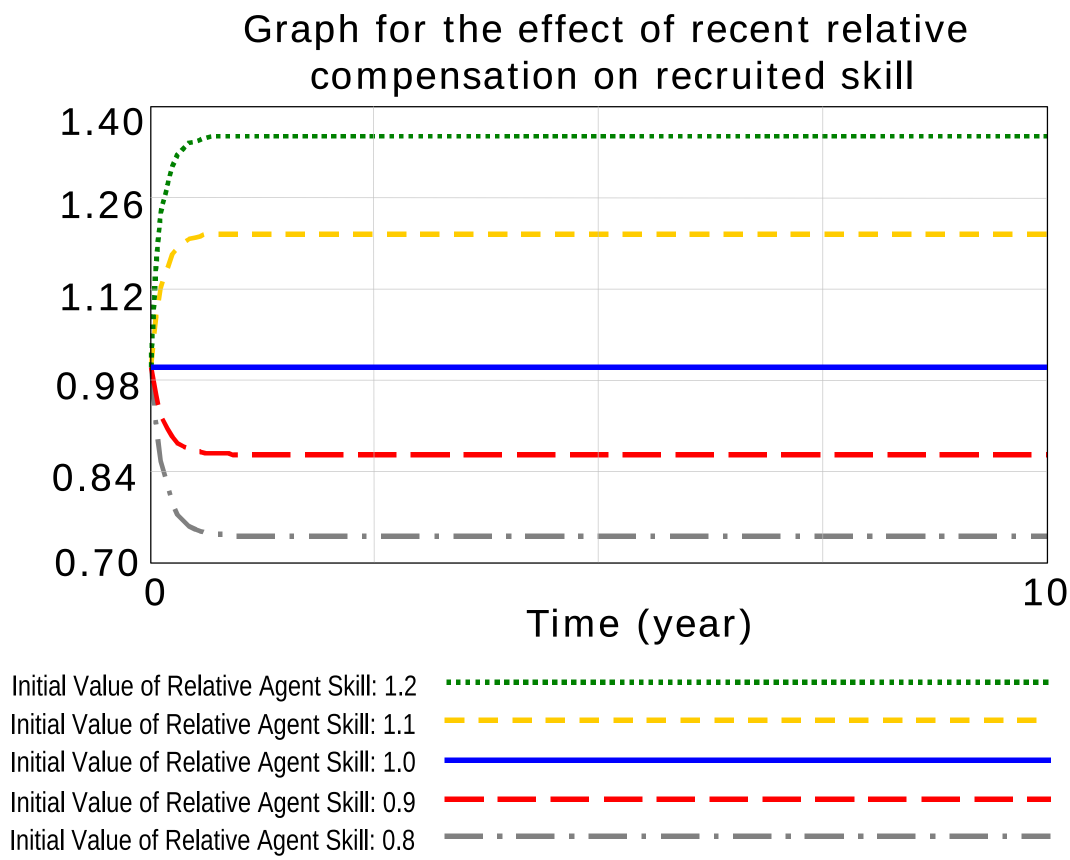
Next we explore the dynamics of the compensation subsystem by itself (Figure 18), which includes one positive and one negative feedback loop. Unlike the collection of sub-systems, which is modeled for Simulation 1, relevant policies are usually not prescribed for this sub-system. Thus, the objective of studying the behavior is to determine whether *Level of Hired Agents* can be a potential source of differential performance and understand its practical implications. The names of the variables in Fig. 18 appear to differ from those in Figure 16 because the emphasis here is more on the loop and less on the intermediate variables. Fixed compensation is set at $5000 per year and expected total compensation is $20000 per year. The annual premium from the standard policy (*Case Size*) is set at $160. To understand the behavior of the subsystem, we will analyze the outcome of the subsystem (*Recent Relative Compensation*) across a range of values for the input (*Relative Skill per Agent*) – 0.8, 0.9, 1.0, 1.1, 1.2. Figure 17 shows the dynamic behavior of the isolated subsystem over ten years. We observe that when the input is different from 1, there is an initial tendency of divergence followed by a stable steady state. We infer that for a given difference of the incoming value from 1, the value of the output stabilizes itself at a value greater than the initial difference from 1.

We explain what is happening in this subsystem by tracing the path of the loops starting from a convenient place – in this case *Relative Compensation*. Irrespective of the value of the input, the initial value of *Recent Relative Compensation* is 1. When the input (*Relative Compensation*) is different from 1, *Recent Relative Compensation* shifts towards the value of *Recent Compensation*. If it is greater than 1, it lowers the value of *Agent Quit Rate* which then lowers the value of *Lapse Rate* below its standard value. This new lower value combines with *Sales Productivity* to increase *Variable Agent Compensation* to a slightly higher value than its previous value. Consequently, *Relative Compensation* increases beyond its original value. This continues in an iterative fashion until the difference between *Relative Compensation* and *Recent Relative Compensation* shrinks away. It is useful to note that this gap is not obliterated in the first iteration itself. This accounts for the delayed, yet restrained pattern of divergence. When *Relative Skill per Agent* is less than 1, a symmetric process of adjustment takes place in the reverse direction until *Recent Relative Compensation* reduces and reaches the value of *Relative Compensation* at something less than 1.

The final key consequence of *Recent Relative Compensation* attaining a value different from 1 is the multiplier (non-linear) effect of *Recent Relative Compensation* on *Level of Hired Agents*. This effect amplifies further the already seen deviation effect (i.e. the deviation effect shown by *Recent Relative Compensation* as a function of the deviation from *Relative Skill per Agent*, described in the previous paragraphs). The graph in Figure 19 gives an indication as to the magnitude of deviation suffered by *Level of Hired Agents* due to deviations in *Recent Relative Compensation*. Note that all the relationships between the different variables in this sub-system have been subject to empirical evidence.

To summarize, when there is a deviation from the steady-state input value of *Relative Skill per Agent* to this sub-system, there is an increased deviation in the output, *Level of Hired Agents*. This increase in deviation can, under appropriate contexts, be the source of a competitive advantage to firms. The practical implication is that if a firm has an average skill level that is slightly higher than the average skill level expected by the market, then it finds it easier and easier to attract agents of even higher skills. Conversely, if a firm has an average skill level that is slightly lower than the average skill level expected by the market, then it finds it more and more difficult to hold onto its skilled agents, who are replaced by new agents with inferior skills.

FIGURE 17 - Compensation Characteristics



Units: equivalent years of experience (above) and dimensionless (below)

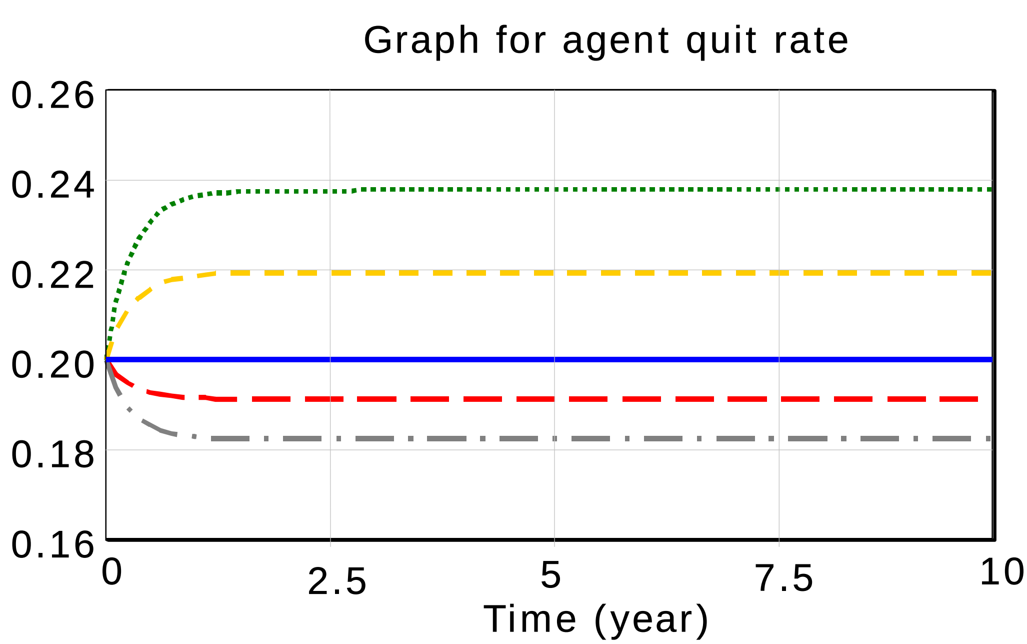


FIGURE 18 - Compensation Sub-system

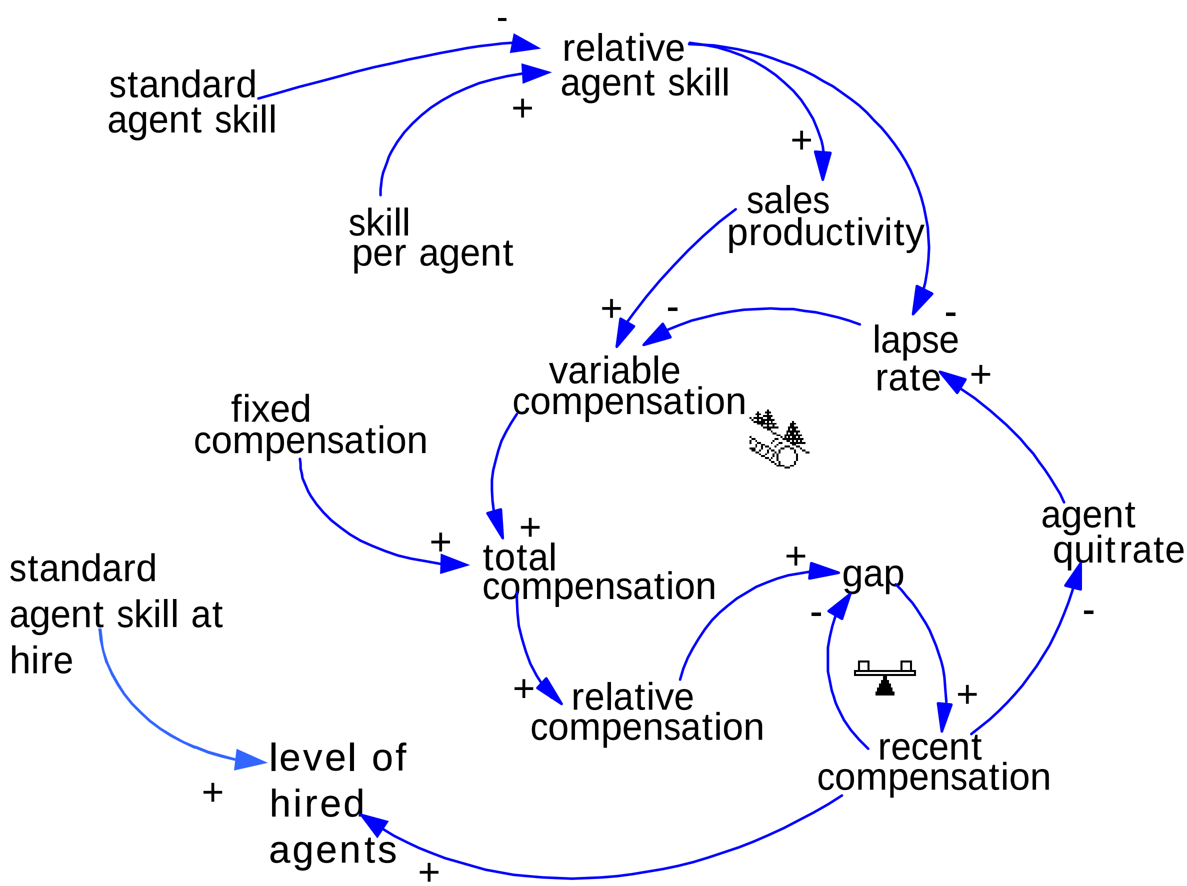
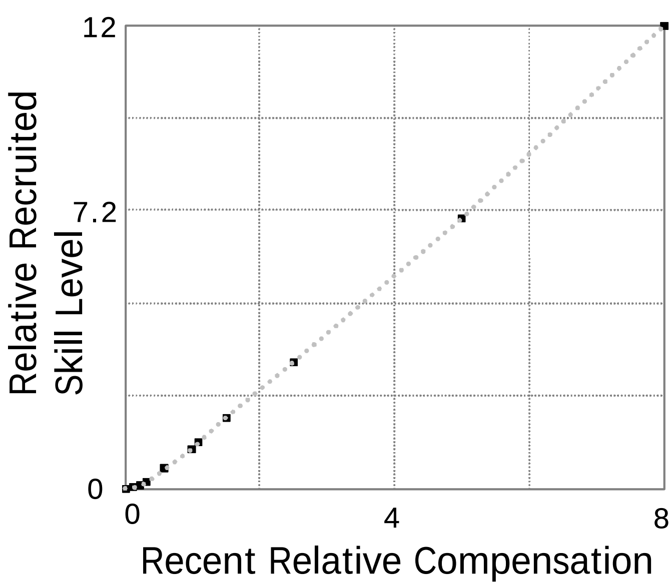


FIGURE 19 - Effect of Recent Compensation on Level of Hired Agents



Relative Recruited Skill Level is an intermediate step and an antecedent of Level of Hired Agents

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