

**A Broader Look at Competition and Cooperation:
New Abstractions for Building and Regulating the Communications Sector¹**

By
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The disadvantage of exclusive attention to a group of abstractions, however well-founded, is that, by the nature of the case, you have abstracted from the remainder of things. In so far as the excluded things are important in your experience, your modes of thought are not fitted to deal with them. You can not think without abstractions; accordingly it is of the utmost importance to be vigilant in critically revising your modes of abstraction.... A civilization which cannot burst through its current abstractions is doomed to sterility after a very limited period of progress.

Alfred North Whitehead
Science and the Modern World³

Abstract

Just when it looked like almost everyone (from business leaders to academics to politicians) had reached some agreement that more competition could bring real benefits to economic systems, the rules seem to have changed. This may mean that everyone was operating with an inaccurate or incomplete view of “how things work” with regard to competition. This paper takes a broad view of how competition and cooperation work and finds some surprising clues for how to “burst through” our current abstractions.

¹ Some of the ideas in this paper appeared for the first time (with more detail and a U.S. focus) in *Competition and Cooperation: From Biology to Business Regulation*, Harvard’s Program on Information Resources Policy, 1998. It is available on line at <http://www.pirp.harvard.edu>

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³*Science and the Modern World* (1926; reprint N.Y.: Mentor Books, 1954).

Introduction

At the end of the Twentieth Century many countries attempted to “open up” their communications sector on two levels of competition: *intraindustry* and *interindustry*. Governments encouraged the formation of new telephone companies and broadcast services to compete with the incumbents in those services (intraindustry competition). They also encouraged formerly distinct industries to compete with each other; cable would compete with telephone and wireless would compete with wires, etc. (interindustry competition).

But while everyone was busy promoting *competition* in communication services as the answer to a wide variety of problems around the world, a wave of consolidation began in the communications sector that resulted in the highest level of *cooperation* the sector has ever seen. The more governments try to promote competition, the more cooperation seems to take place.

Competition did appear in some of the communication industries, but few predicted that it would be accompanied by the development of giant, multinational entities in which many large communications companies would merge to make even larger ones. In some countries telephone companies would become some of the largest owners of cable systems. Broadcast and print companies around the world experienced unprecedented consolidation of ownership. For a while it looked like Internet companies would gobble up “old” communications media companies (and in the U.S. at least one did). The communications sector began to look as if it might evolve into several large organizations, with much multinational and interlocking ownership that enables vertical and horizontal integration. The result has left many wondering what went wrong and whether it is possible for competition in the communications marketplace to be predicted (or governed) at all. Some abstract questions seem ripe for asking *again*. How does competition operate? When is cooperation good and when is it bad?

Governments have often seen consolidation in the communications sector as more dangerous than similar tendencies in other important sectors such as manufacturing because communication plays such an important role in the operation of all industrial sectors and in the economic and political systems of every country. Without an efficient, fast and cost effective communications system, information about the availability of goods and services, data about current prices, and intelligence about the costs of other factors of production could not speed around the world, making globalization possible. Any concentration of economic and political power in the communications sector will seem dangerous to many in both the private and public sectors. Larger, more powerful communications companies will not be welcomed by their customers, their smaller competitors, or by governments that see them as a threat to national sovereignty.

Current political ideas about industrial competition and cooperation are rooted in the two modes of human behavior that, to some extent, have shaped all of the world’s cultures. All societies (consciously or unconsciously) seek the right blend of cooperation and competition. After much experimentation, it has become clear that human societies must balance these two modes of operation if they hope to achieve some level of political and economic stability.

Both cooperation and competition found champions, the former in Karl Marx, and the latter in Adam Smith. The followers in each group promised utopia and characterized the other group as evil. But, in fact, no society (and no economic entity) has ever been entirely one or the other. Wherever there is a scarce resource there is competition and wherever two or more people work together to get that scarce resource, there is cooperation. Competition and cooperation exist together in any environment. It is their *interaction* that forms the economic structures we observe.

No assumption is made here that either cooperation or competition is in itself good or evil but, instead, that various blends of these behaviors are possible in human systems and they will have different effects in different environments. The tool we develop in this chapter does not favor economic or political structures for either cooperation or competition and it will work the same way in both of them. It will be useful for those who have more faith in cooperation and for those who are committed to increasing competition. People of both persuasions will find they accomplish their goals more often if they understand what they are working with.

Competition and cooperation in networks may be a special case since networks are, by their nature, cooperative structures. The introduction of competition has certain predictable, and sometimes undesirable, outcomes. Here are a few of the surprising insights that we get by looking at competition and cooperation from this broader vantage point:

- **An increase in either competition or cooperation will precipitate an increase in the other.** A new competitor in a system can cause the individuals in the system to band together to fend off the new competitor. In a stable system with no immediate outside threats, new cooperation among some of the individuals will increase the level of competition for the scarce resource in question. For business strategists and policy makers this means that keeping an industry free of government protectionism or regulation may encourage *more competition* in the short term (by lowering barriers to entry, for example), but experience has shown that competition is expensive and competitors will try to reduce it by *more cooperation*, perhaps by dividing up territories or markets. Governments have expended considerable effort to stop this kind of cooperation, but with limited success and often with confusing theoretical and political justification. If policy makers had used this tool they might have been able to predict that introducing new competition into the communications sector would elevate the level of cooperation in the form of vertical and horizontal consolidation.
- **An economic entity cannot both compete and cooperate for the same scarce resource at the same time.** It is possible, however, to cooperate with regard to one resource and compete with regard to another, or to cooperate at one time and compete at another time. This idea has important implications for a public policy or a business strategy that assumes competitors will cooperate with one another with regard to a scarce resource, such as channel capacity. For example, it appears to be unlikely that companies both compete for customers and cooperate with regard to the price paid by *those same customers* for access to network infrastructure. Any outside authority (like a government) will have little success mandating such behavior in the long term.
- **An economic entity will cooperate in getting a scarce resource *only* as long as they think they are getting more than they would get acting alone.** This and other insights about the nature of cooperation will be useful to managers of multi-industry and multi-unit companies where the individual parts are asked to cooperate with newly acquired companies who are former competitors. It will also be useful for managers who must now compete with companies they used to cooperate with.

But in order to reach these insights we need to some definitional bridges that let us bring these important concepts from biology to business. The next section will build these bridges and dispel some commonly held misunderstandings about the process of natural selection.

Biology and Business: Definitions for a New Big Picture

Competition and cooperation are not unique to human systems. Both of them operate in all biological systems, and, when you take a close look, biological systems are analogous to business in many ways. The competition between jellyfish and barnacles is surprisingly similar to

the competition between different industries. The cooperation within wolf packs is similar to the cooperative behavior within and among companies. If that sounds like a long way from the way we usually think about competition regulation, you'll be glad to know that the pathways between biology and business have already been blazed. Economists all over the world are looking to biology for ideas that will help make the "dismal science" more predictive. Biologists have, in turn, gotten new insights from economics. (Hodgson, 1996) Fortunately, business executives and policy makers need not be experts in economics or in biology in order to use the insights gleaned from this interdisciplinary work.

Many popular business publications have used biological or so-called Darwinian analogies in discussions of business strategy. Not all writers using these terms have understood the underlying biological concepts and many became highly controversial when they stretched the biological principles to fit preconceived economic or political notions about industrial or social "fitness." However, the fact that biological and industrial systems are similar enough to generate important insights has not itself been controversial.

Some of the most interesting analogues for a broader consideration of cooperation and competition come from the branch of biology known as *ecology*. The word "ecology" was coined in 1866 to denote the study of the "economy of nature." It attempts to explain, in general terms, the interactions among individuals of one species (*intraspecies*) and among different species (*interspecies*). Ecology takes into account many other fields, including physics, chemistry, mathematics, climatology, as well as the many other branches of biology. Sociobiology, which applies ecological ideas to human activities, has been controversial in some circles, usually in relation to the debate on whether "nature or nurture" is the preeminent force in human behavior. It is not necessary to leap into that fray, however.

The biological concept of *evolution* or *natural selection* has been widely misunderstood (and abused) in popular literature and political discourse concerning competition. It is *not* "survival of the fittest individuals." Evolution operates only by differential reproductive success, which is to say, by how many new members are added to the population in each generation. The ability of particular individuals to survive (perhaps because of better strength or speed) is important only if it affects the number of surviving progeny. Natural selection should not be thought of as "dog eat dog" or "the race goes to the swiftest." An adaptation that makes individuals aggressive or fast may be helpful in some environments but could be counterproductive if their environment changed so that more cooperative and deliberative individuals left more survivors. The concept of natural selection does not support judging some species or individuals "fitter" than others on an evolutionary time scale, because no one can predict what challenges an individual or a species may encounter in the future. Fitness is a moving target for all individuals and all species as well as for all firms and all industries.

A reader relatively familiar with economics will be wondering how some of these biological concepts translate into a business context, that is, when does an industry or a firm have greater fitness? The term *fitness* is used here to refer to the ability of the industry (actually, its individual firms) to, over time, leave more value for shareholders. This would seem a fairly noncontroversial way to measure success in the long term. If a firm is providing lower rates of return on its investors' capital, it is certainly seen as less fit. Increased fitness may or may not mean an increased marketshare or larger work force. Similarly, it may or may not mean being more aggressive, faster to get new product to market, having more assets, or having a bigger (perhaps international) territory. Any of these factors, however, would increase fitness in certain economic environments. Fitness changes over time, particularly in times of rapid change in the industry's environment (new regulation, new technology, etc.). What once was a very fit

telecommunications company may now be doomed to extinction, unless, like the barnacles we will soon meet, it can find a new type of food to eat.

The term *adaptation* is used here to mean any characteristic that comes with the firm when it is sold or when its management changes, such as its technology or distribution system. These adaptations will increase or decrease the fitness of the firm or industry in a given economic environment. *Environment* means all the forces that have an impact on the industry—government, suppliers, customers, and macro economic forces, such as inflation and interest rates.

A common misconception about adaptation is that it necessarily leads to changes in the individual or the species that are the best or the most efficient. Some adaptations may be merely *efficient enough* to allow more reproduction by those that adopt it, but not the *best possible* solution to a problem. Adaptation often survives solely because it appeared at the right time and place. In economic and technological systems, adaptation can become “locked in” even when it is not the best answer to a problem, such as the QWERTY keyboard layout. In most cases, an evolutionary process will lead to improvement because it represents adaptation to change in the environment. But adaptation to the current environment can lead to a disastrous outcome if the environment changes too rapidly. If natural selection always led to the best *long-term* answer, dinosaurs would still rule. They were well adapted to their environment, but when that environment changed too rapidly for them to adapt by natural selection (over many generations) they became extinct.

The concept of equilibrium is found in both economics and biology. Debate is increasing in both fields about whether economic and biological systems ever reach a state where forces exactly match each other to bring the system to some kind of rest. For purposes of this tool, *equilibrium* is a situation in which the system moves within a narrow range and is not in a period of wild fluctuation. Many things can throw a system out of equilibrium. One of the most common is a reduction in a critical resource. In a stable system, where allocation of scarce resource has evolved to an equilibrium, a reduction in one or more of these resources will cause former cooperators to compete or former competitors to cooperate, or both. In the business world, when a resource such as customers becomes more scarce and firms or industries cannot find substitute customers, the scarcity will drive firms that had cooperated with respect to that resource (e.g., through territory allocation) to compete. A reduction in resources can also drive those that had formerly competed for it to cooperate (e.g., through collective buying or coordinated government relations).

Biological systems exhibit a variety of *modes of interaction* between different species (interspecies) and between individuals of the same species (intraspecies). There are no examples in nature where two or more of these interactions exist simultaneously as between two individuals or populations. For instance, two individuals will not compete and have a parasitic relationship to each other. Similarly, there is no evidence that individuals or groups ever compete and cooperate at the same time and the same place for the same resource. Thus, cooperation and competition appear to be different modes of behavior and not two ends of a spectrum where any particular behavior could be characterized as “somewhat cooperative” or “extremely competitive.”

Ecologists define *competition* as an interaction between individuals or species, brought about by a shared requirement for a resource in limited supply, and leading to a reduction in the survivorship, growth and/or reproduction of the competing individuals concerned. (Begon and Harper, 1990) This is seen in two different modes: the Scramble and the Contest.

In the *Scramble* one species or individual uses up resources to the detriment of other species or individuals without a direct response from those displaced. For example, a plant species might colonize all the available sunny spots in a forest clearing or a herd of buffalo might eat all the available grass in a grazing area. In both cases they are depriving other species of a critical scarce resource and driving them off the territory or into extinction. Interspecies competition often takes this form.

In the *Contest* a species or individual responds directly to attempts to displace it or to appropriate a resource it uses. This situation can be observed in contests over territory or in dominance hierarchies, and it can take many forms, including siege, harassment, and actual battle. This strategy is observed where the resource in contention is large enough to spend energy defending but small enough to be surveyable and controllable. An individual panther might actively defend a part of a forest that is large enough to support itself and its juvenile offspring but the territory must be small enough that the panther can detect intruders. A group of animals who live together in a dominance hierarchy would defend a “kill” they have made against other species or other groups and fight among themselves for who gets to eat first.

Michael Porter opened his now classic work on business competition with this advice: “The essence of formulating competitive strategy is relating a company to its environment.” He then describes how firms capture resources relative to other firms or another industry that seeks to use the same resource. Porter also describes the way economic entities die and economic species go extinct: other economic entities use the resources necessary for them to survive. He recognizes that business competition need not involve an active contest, but, over time, a scramble for the resource can result in the extinction of an industry or a firm. (Porter, 1980) Policy makers and business strategists who focus on competition that looks like a contest, sometimes ignore the scramble mode of competition, even though it can be just as important to the survival of an industry.

Some business interactions look like *predation* (e.g., predatory pricing to “starve” the competitor by taking all its customers or buying a competitor with the intent of shooting it in the head). *Parasitism* can be seen in business relationships based on fraud – where one party tricks the other in to thinking it is getting a benefit or where one entity takes something by force but gives nothing of value in return. *Mutualism* might find its analogue in business agreements where both parties receive the same benefit, such as when two firms get together to divide territories. Both receive the same benefit because neither needs to compete anymore with the other. Of course any kind of relationship can have effects on parties who are not direct participants. In economic systems, when two firms or two industries divide up territories it tends to increase the price each can charge their customers, which then has a detrimental effect on another species in the economic environment, consumers. *Protocooperation* is probably best observed in the joint ventures and “alliances” that began to be common in the 1990s. Analysis of their successes and failures might benefit from a study of protocooperation in the natural world.

True *cooperation* usually occurs where the safety or survival of the parties depends on sharing resources. It will continue as long as all those cooperating receive more of a scarce resource than they would by competing with the others. The cooperative interaction results in more scarce resources being acquired than would be possible by individual actions. This is sometimes referred to as a “non-zero sum game” because a gain for one cooperator is not a loss for the others. The benefits of cooperation can lead competing firms to merge in order to achieve greater economies of scope and scale, giving them benefits that neither could achieve on their own. Firms will split apart when one unit concludes it can get more of its important scarce resources by going it alone.

The concept of *scarcity* becomes a broader concept here than many communications executives and policy analysts have granted it in the past. Scarcity has generally been discussed in terms of channel capacity. For example the electromagnetic spectrum is said to be a scarce resource because not everyone can be assigned a frequency of his or her own. Telephone and cable systems were said to scarce resources because the cost to build them often made them “natural” monopolies. This concept of scarcity became the theoretical underpinning for the allocation of access to communications channels by government. The explosion of technologies such as new wireless systems and the Internet increased the number of channels while the capacity of each channel was increased by innovations such as fiber optics and signal compression. This new abundance of channels and channel capacity threatened an important equilibrium assumed in many business and regulatory strategies.

Another important group of scarce resources (maybe the most important in many situations) is the time, attention and money of customers for point-to-point and point-to-multipoint communications services. These resources are not unlimited, and the allocation of consumer time and money by the market (that is, by competition and cooperation) will be the primary focus of business strategy and competition policy in the foreseeable future.

In much of the literature that compares biology to business, the “unit” that adapts to changes in the economic environment is said to be the institution or the *firm*. (Hodgson 1996) A firm is thus regarded as an individual member of its industrial species. Successful adaptations by individual firms will mean more of them will survive.

What is a *species* in the business world? In biology, a species is a group of individuals that may be expected to have many fundamental features in common, to use similar resources and to react in much the same way to changes in environmental conditions. (Begon and Harper 1990) This is closely analogous to the typical use of the term “industry” as a group of firms that share many institutional and technological characteristics, compete for the same resources (both production inputs and customers), and can be expected to respond in similar ways to changes in the environment. The analogy is useful for the investigation of competition and cooperation within and between industries and for analysis of communications firms that are evolving or “converging” to form new industrial species.

Finally, it is important to acknowledge that any similarities between biological and human systems will always be imperfect, because human beings can look into the future and, on the basis of assumptions about future events, they can change their behavior. This capacity accounts for the behavior of such human systems as the stock market. It allows human beings to change habits and other characteristics that would be more stable and thus more predictable in other organisms. Human beings also exhibit more complex resource requirements than other species. For example, given an opportunity to maximize their economic gain, some human beings may forgo it for the sake of serving other needs (such as ego gratification), a characteristic other animals appear not to have.

With those definitional bridges in place, it’s time to look at the Big Picture. In the following sections (and the chart attached here as an addendum) we will look at competition and cooperation at both the interindustry and intraindustry level. Readers interested in more detail about the biological principles should consult the author’s earlier Harvard paper (See, footnote one) and the references noted at the end of the paper.

From Biology to Business: Interindustry Competition

Interindustry competition exists when more than one industry seeks to use a scarce resource, i.e., one not available in sufficient quantity to satisfy all industries who want to use it. The resource may be anything needed for survival of the business: customers, production input, labor input, capital, etc. Competition can be a *contest* (e.g., actively seeking another industry's current or potential customers through marketing, price competition, etc.), or it can be a *scramble* (e.g., one industry uses more of a resource such as bandwidth, power, consumer time, so not enough is left for others to use).

For policy makers trying to encourage competition, some of the most important insights from biology may be those that deal with the costs of competition. We seldom acknowledge that competition is expensive. Time and resources spent on competitive activities reduce the time and resources available for other critical activities, such as long-term investment in plant, equipment, and employee training. It also reduces fitness in the short term by lowering returns to investors. There is no free lunch, even when you are eating somebody else's. This is not to say that competition is bad, but that the predictable costs should be acknowledged in advance and appropriate steps taken to minimize adverse effects. Competition is often referred to as a “zero sum game” because it results in winners and losers. Over time, losers will suffer displacement (loss) of investment and jobs.

When industries that “look like” each other fight over a resource that they both need to survive, they are at risk of falling victim to the competitive exclusion principle. Over time one of them will either go extinct (bankrupt) or find some other resource to use. If these industries use certain customers as only *one of their several markets* for the product, both industries may survive at a level of equilibrium if there is not too much overlap in their markets (e.g., if both firms also market the product to different segments of business and residential markets). The competitive exclusion principle may well have been at work in the extinction of Betamax video and eight-track audio businesses. These are both “network markets” i.e., their customers want to buy products that are compatible with those purchased by other consumers. Network markets are said to be “tippy” in that one product will eventually tip the balance and take over the entire market. In such cases competitors can avoid a competitive fight to the death by picking the industry “standard” (i.e., the winner) in advance, either by mutual consent or by asking government to impose one. A government imposed standard or patent on the winning technology makes it difficult for other industries (or firms from other countries) to invade this market.

Michael Porter lists five competitive forces that determine the level of competition in an economic system: (1) the entry of new competitors, (2) the threat of substitute products, (3) the power of buyers, (4) the power of suppliers, and, (5) rivalry among current competitors. These forces can determine whether one industry can successfully invade the territory of another. Potential entrants may be firms or industries that have never had a territory before (entrepreneurs), have lost their old territory, or have just learned to use the resource of the incumbent industry (perhaps with new technology). Two important barriers to the entry of competitors identified by Porter are economies of scale and government policy. (1998, 21-38)

Often, the best way to keep other industries away from a resource is to establish a barrier around your territory and defend it. The least expensive way to do this is to have government set up the barrier and keep everyone else away. This can be accomplished through licensing schemes for access to government resources necessary to entry (local right-of-way, spectrum, etc.) or by making the cost of doing business higher for new entrants, through taxes, government regulation, etc.

Another way to avoid competition in both biology and business is developing specialization or what both systems call a *niche*. This can be done as a deliberate strategy or the industries can drift in this direction without deliberate intentions to do so. In both cases they will refrain from using resources in the areas where competition is the fiercest. This can result in an equilibrium separation distance between the industries and make them less vulnerable to competitive exclusion. This can be seen when industries drift apart in their product differentiation, customer base, or the countries where they operate.

When an industry uses up all the resources in one area (e.g., it reaches maximum market potential) or abandons a niche or market segment to the competition, it must look for new resources for growth. In an economic system where access to capital is based on growth potential (e.g., through the stock market) it becomes necessary for each industry to be growing. This means a constant shifting of competitive balances, making any kind of economic stability hard to achieve. This lack of stability may have a detrimental effect on the diversity of industries that the economy can support.

Industries look for new resources for growth by developing new products, entering a closely related product market, or entering a neighboring territory for the same product. In some cases the competition will be obvious and will look like a contest. In other cases the competition will look more like a scramble, particularly where the products are not perfect substitutes for each other (they don't look exactly alike). This may not look like direct competition, but the substitute will eat up scarce customers that would have been used by the incumbent industry. Over time, the substitute product can slowly accumulate so many of these scarce customers that capital will start flowing out of the incumbent and into the industry offering the substitute. As a result, the situation will look more like intraspecies competition and may shift from a scramble to a contest with active advertising and market share battles.

Economies that have a reliable (even if not unlimited) amount of the resources needed by their industries (capital, labor, raw materials) tend to be more stable, because the situation allows allocation of the resources to evolve toward equilibrium. Economies with unreliable access to critical resources (such as oil) will endure industrial “shocks,” which upset allocations and destabilize the economy. Stable economies tend to support more diversity in their industries because the resources allocated to each industry remain stable.

A stable economic environment can also support more diverse industries if each industry finds a relatively secure *market niche* not in danger of invasion by other industries. But when one industry loses access to a critical resource (capital, labor, customers), it may look to resources used by others. If the resource is scarce there will not be enough to go around and some of the industries that compete for it will lose. If an industry begins to lose access to capital because of its market saturation (limiting its growth potential), it may try to invade the turf of a closely related industry, using up some of the limited customers for that good or service. This will increase competition for those customers and if the competition is fought on price the customer will benefit, at least in the short term. But the competition is also likely to reduce the number of industries that will survive.

Intraindustry Competition

Intraindustry competition takes place between firms in the same industry. The goal of intraindustry competitive strategy, according to Porter, is to find a position in the industry where the company can best defend itself against competitive forces or can influence them in its favor.

(Porter, 1980) This sounds a lot like one of the intraspecies competitive strategies: find a territory or a grouping of resources and defend from competitors. Establishing a territory allows the firm to avoid using too much of the aggressive behavior that will rob them of energy for other survival tasks. The best competitive strategy is one that lets you avoid competition as much as possible.

Intraindustry competition takes place between firms that look alike (e.g., between telephone companies or between television networks). This competition between firms tends to be fiercer than interindustry competition because firms in the same industry compete for the same resources (customers, production inputs, etc.). Competition between TV stations is fiercer than between stations and newspapers because all the local stations hunt for the same advertisers while newspapers hunt for only some of those sought by broadcast and they have some that broadcasters don't go after at all. Their niches overlap to some extent but not 100 percent because they have different competitive advantages. However, if TV stations and newspapers both begin to distribute information, entertainment and advertising on the Internet, they will start to "look like" each other. When this happens the competition between them is likely to look more like intraindustry competition – it will become more fierce and they will develop tactics to keep firms that look like them off their territory.

Like intraspecies competition, intraindustry competition can act to control the population of firms in an industry. In a territorial competition there will be winners and losers. The territory need not be geographic; it can be a resource niche or a market segment. When the current territory of a firm is invaded by a similar firm, the battle can be intense because the fight may be "to the death" because of the competitive exclusion principle – if they both try to use the same resources at the same time one of them is likely to end up in bankruptcy or to leave the market.

A firm may become vulnerable in a scramble or a contest because of a reduction in a critical resource (e.g., fewer radio listeners) or because more individuals are trying to use the resource (e.g., government grants more radio licenses). In both cases, the number of firms will decline until it reaches a level the resources in the environment can support. Winners will manage to get enough of the critical resources to stay alive. Losers will not and will go bankrupt or sell out to a stronger competitor. Thus, the net effect of increasing the competition in an industry with dwindling access to a limited resource will be either to "cull" the weakest competitors or force some of the competitors to cooperate. Cooperation will reduce competition and can take the form of mergers and acquisitions but can also include less formal (or public) arrangements such as agreements to allocate customers or establish new territories.

The same forces that sometimes favor large individual organisms in the biological world also act on business firms. In the face of increased competition, larger firms are often better at a scramble because they use up more of the limited resources that would have been available to smaller competitors. They are also better at a contest because they can use more resources to aggressively push smaller competitors off the turf. An ability to accumulate resources and maintain some internal diversity will also make larger firms less vulnerable to environmental fluctuations (e.g., changes in technology) and extreme conditions (e.g., economic recessions) than the small firms are.

Individual firms in most communications industries have relied on territoriality to gain and maintain access to resources. They have used resources at their disposal to become very "fit" for their environment, i.e., they were able to give good returns to their owners, even though they were not particularly fast or aggressive or efficient. Unlike incumbents in biological territories, most of these firms in many communications industries did not need to defend their territory—governments did that for them. But as these government defenses fall to the forces for

liberalization, and new technology breaks down other barriers that protected the old territories, individual firms may be expected to try to gain new territory that they can defend.

When things go up for grabs the competing firms are faced by the same choices available in the biological world:

- *Find a new resource on your present turf.* This might mean using present infrastructure or expertise to sell other services to present customers, thus finding new resources to make up for those taken away by the new competitor. Unless the service is totally new and not a replacement of another currently available in the market, a firm should prepare to fight current providers of that service on their turf. If the firm is a telephone company that serves everyone on its turf, it may find itself competing with some of its own best customers (e.g., mass media firms who use a lot of telecommunications services) as it tries to find new ways to use its assets.
- *Move to a territory you can defend.* If the invader whose forces are massed at your border looks unbeatable, you may want to avoid a fight and just move on. This may mean moving to a smaller territory (one you have enough resources to defend) or it may mean aggressively taking a territory where the incumbent is weaker than you are. Maybe you take the resources you've stored up and try your luck in another industry where you may have a competitive advantage over other individuals.
- *Stay and fight, but make the competition expensive for the other side.* The firm could let it be known that it will fight to the death and that any invaders can expect to take so many casualties they will be unable to defend the territory even if they win. The firm could also set up a "spite" situation (e.g., selling below cost) that will hurt them but it will hurt the other side more. Or one firm could make the other's access to a critical resource more expensive than theirs (such as, making sure suppliers give them a better deal).
- *Get bigger.* Larger firms may gain access to increased resources, which will permit them to put up a better (and longer) fight and make them appear more formidable in either a scramble or a contest; as a result, smaller competitors will not even try to challenge the turf. An organism or firm can increase in size by forming permanent coalitions (mergers) or temporary ones (joint ventures, alliances) or buying up dying firms to make sure they don't become a problem.

Some of these options are legal in most countries and others generally are not. They are, however, very predictable reactions to increased intraindustry competition and regulators should not be surprised when they happen. Several of these options involve some form of cooperation. As we have seen in both biological and business systems, cooperation is a typical response to increased competition. In the next section we will look at why cooperation occurs in biological systems and how those same forces play out in business.

Cooperation

Efforts to understand and encourage cooperation are as old as human societies. Many disciplines have added clues but the ultimate answers remain elusive. In the last part of the twentieth century these questions began to be analyzed from an interdisciplinary standpoint, trying to find things that are common to all systems where two or more entities combine forces to get scarce resources. The ideas being developed will have an impact on many human interactions, economic, political, and military. In this section we will look at some of these ideas and the implications they have for cooperation in the communications sector.

As we have seen, cooperation is clearly related to competition, but the exact nature of that relationship is not easy to pin down. They can cause each other and yet they never exist together. Competition and cooperation seem to be different modes of behavior that are used to acquire scarce resources. Sometimes the best way to compete for a scarce resource is to cooperate with someone else. This kind of cooperative relationship doesn't necessarily mean that the number of competitors in a system will go down because it may cause you to compete with your partner's competitors (the enemy of my friend is my enemy). This can result in a net increase in the number of competitive relationships in the system. Your new cooperative relationship may also cause others to cooperate in order to compete with your partnership.

No individual or firm is likely to enter into an arrangement where they have to share their resources with another person or entity if they could get just as much operating alone. After all, cooperating means giving up some of the resources you collect, and it means giving up some of your autonomy. Giving up your autonomy (or your "freedom") would be a high price to pay if you could survive on your own and cooperation will only get you marginally more of a resource you need. But if both of you can only survive by working together, then cooperation seems the only rational choice.

Human business organizations are clearly cooperative constructs formed for the purpose of competing for scarce resources, but what makes them come together – and come apart? If you are a policy maker who wants to encourage competition, what kinds of cooperation are good and what kinds are bad? These questions have been looked at in economics through the lens of Game Theory. As we saw in the last section, competition is often a zero-sum game where there are winners and losers, one side's loss is the other side's gain with zero left over. Non zero-sum games are those where both sides come out ahead and the fruit of their effort is larger than their individual efforts.

Experiments with computer simulations have demonstrated that "players" who used a tit-for-tat strategy could gain the most points (become the most fit) over many "rounds" of play and that this strategy would spread to others, who saw that it would increase their own fitness. This "game" consists of many iterations (generations) of a scenario developed by economists called The Prisoner's Dilemma. (Axelrod, 1984) In the game, two players have two choices, either cooperate or defect. The game is usually explained as a story about two prisoners arrested for committing a crime and then asked to testify against each other. If both agree to testify (that is, if both defect), both lose. If one agrees to testify in return for a reduced sentence, that player wins something but the other player loses. If both refuse to defect (that is, if they cooperate with each other), then both win, because the police will not have evidence to convict either. The complication is that at no time can the players communicate with each other.

The Prisoner's Dilemma is simply one formulation of some very common and very interesting situations where everyone would be better off with mutual cooperation. Axelrod saw many examples of this strategy at work in nature and in business and it has been widely discussed in both natural science and social science literature. He found four things that are necessary (but not necessarily sufficient) for cooperation to become established in biological and human systems:

1. There is a good chance that individuals (firms) or species (industries) will come into contact with some frequency in situations where they have a choice of cooperating or defecting.
2. This contact will be for an indefinite period.
3. The individuals or species can recognize each other.

4. The individuals or species can “remember” what happened in the previous encounter.

In order for cooperation to develop the parties must have some means of communication so that they can identify each other. Communication is thus a critical first step in cooperation but it is not, *by itself*, sufficient. This belief in the unalloyed power of communication was one of the great fallacies promoted by some early advocates of a utopia called the “Information Society.” Cooperation *also* requires a likelihood of frequent contact where the parties can *choose* to cooperate or defect, the ability to accurately recognize each other, and the ability to remember what the individual did in the last cooperate/defect interaction. These additional requirements form the basis of the second arm of cooperation: trust. Contrary to much Internet rhetoric, communication does not, *by itself*, build trust in any system, animal or human.

In the next sections we will look at cooperation in the same way we looked at competition: interindustry and intraindustry. We will pay special attention to how Axelrod’s criteria play out in these settings.

Interindustry Cooperation

Like two species, two industries may evolve cooperative behavior when it increases the fitness of both. It emerges in the presence of the four criteria identified by Axelrod: the industries are in frequent contact; the contact is for an indefinite period; they recognize each other; and they remember what happened in their last encounter. Cooperative behavior is more likely to emerge when new competition creates uncertainty about the future of one or both industries and they are seeking alliances that will help them compete more successfully. The new competition might be from a similar industry trying to invade the territory (from other countries, for example) or from another industry trying to capture customers with a substitute product (video via satellite competes with both broadcast and cable). Cooperation is also frequently seen when one or both of the cooperating industries have high sunk costs, which means that responding to the competition by finding a new niche will be difficult in the short term.

Many business gurus have argued for a greater emphasis on cooperation in the search for competitive advantage. They urge the creation of interdependent “networks” or “environments” when industries have reciprocal relationships, i.e., they play a non zero-sum game that brings benefits to all participants. Obvious examples are supplier relationships that develop between two industries, such as those between hardware suppliers and firms acting as communications channels. An on-going relationship is important to keeping it a cooperative one. An occasional or sporadic relationship can result in one industry being tempted to defect on some occasions. If the resource supplied by one of the industries is needed by the other only occasionally, if the supplier does not have a long-term contract, if the supplier deals through a variety of distributors, or if the supplier deals with many firms in the industry, a truly cooperative relationship will be difficult to maintain. A parasitic relationship would develop when suppliers that take advantage of a high firm turnover or a large number of firms in the industry. They would defect by delivering poor quality or overpriced goods because they know the firm may not be around long or there are many other firms to deal with so this defection will not matter.

Induced cooperation may occur, in which one side tricks the other into thinking it is acting in its best interest or offers the other industry some inducement to temporarily ignore its own interest. As in the natural world, such cooperation will last only as long as the inducement exists. When the other firm or customer knows it has been tricked, or when the supplier no longer receives above-market prices, it will do as self-interest dictates.

Sometimes governments provide these inducements for cooperation between two industries in order to further some public purpose such as technology development or providing networked service such as Internet access or telephone service. These policies would stand a better chance of meeting their goals if policy makers made sure that the inducements are temporary and allow *real* cooperation to develop. Axelrod's four criteria would be met if policy makers encouraged:

1. Long-term commitment enforceable by both sides, usually by contract,
2. Frequent contact, in which the parties must cooperate or defect (frequent meetings are not enough, there must be an opportunity to cheat or not cheat in order to build trust),
3. Communication systems that let the parties recognize each other's agents and interests, and
4. Staffing policies in both the regulated industries and the regulatory bodies that does not encourage personnel to turn over so quickly that no one remembers whether or not the other people cheated in the last encounter.

A cooperative relationship with a supplier is put in jeopardy when the two industries begin to compete for the same scarce resource, such as customer time/money for entertainment products or wireless Internet access. It is not possible for two industries to cooperate and compete at the same time for the same resource but they may be able to cooperate with regard to one resource and compete with regard to another. Their activities can still be mutually beneficial if they can adequately separate their competitive activities from their cooperative ones, perhaps by establishing separate divisions or setting up separate joint ventures for cooperative endeavors.

Of course, not all cooperation between industries is perceived as good by governments. Sometimes cooperating with suppliers or large customers can put the competition out of business. Regulators generally frown on things like exclusive dealing agreements, whereby suppliers of a critical resource refuse to deal with a new competitor. For example, film production firms could refuse to deal with satellite-based services in order to protect their best customers in the broadcast and cable industries. Similarly, customers can protect their suppliers with long-term, exclusive supply agreements. This would leave no opportunity for other suppliers to compete for that business. Regulators may view both examples as serious restraints on trade.

Whether interindustry cooperation is seen as good or bad depends on your vantage point. Cooperation will always benefit those engaging in it (unless it is induced), but when it is used to gain a competitive advantage over a third industry that will not survive the tactics of the cooperating industries, governments get anxious. From one vantage point this cooperation is merely Schumpeter's *creative destruction* in action as it weeds out weak players and redistributes resources to where they can do the most good. (Remember that increased interindustry competition often has the effect of making one industry leave the market.) From another perspective, increased cooperation between industries that are fighting a third one can be seen as detrimental to an optimal level of competition between industries, that is, a level of competition that benefits those who must buy the scarce resource provided by that industry. If, as some predict, "convergence" in the communications sector causes the various communications industries to develop increasingly complex and international relationships, these new webs of dependencies will make it increasingly difficult to recognize, let alone deter cooperative behavior that may reduce the level of competition in any of the industries.

Intraindustry Cooperation

Cooperation among firms can emerge naturally, even when they are economic competitors. In fact, cooperation is a predictable response to competition. The intraindustry consolidation in all of communications industries that occurred in the late twentieth century is a testimony to the existence of this process.

An organization will act on its own so long as it gains all of the scarce resources it needs to survive and produce acceptable returns for its owners. Economic literature often cites the archetypal economic cooperation of the stag hunt, where two hunters working together kill more meat than either could alone. Adam Smith saw this kind of interaction as simply the rational choice of self-interested agents. If a group can command more of a resource than individuals can alone, then cooperative economic behavior would be expected to be selected for over time because it makes those who practice it more fit. Within an industry large firms would be expected to be more successful on average than small ones since they are getting the benefit of more individuals engaging in cooperative behavior. In human systems, cooperation does not require many generations to emerge but can do so in the short term, when two or more organizations follow a cooperative strategy that gets them more resources, and similar firms learn from and imitate their success.

Altruistic behavior is rare in interactions between firms in the same industry because relationships there do not approximate kinship. Indeed, as we have seen, competition will be strongest between firms that look alike. But if firms are not willing to suffer or die for each other, they can and do benefit from cooperation. Group signaling is a common form of intraindustry cooperation. It is used to compete with a product or service that can be used as a substitute for that offered by the cooperators. For example, many firms, particularly commodity producers, form coalitions to promote their products through joint advertising. Signaling can also be used to reduce competition within the group. An announcement that one firm will not increase its prices may signal a desire for mutual restraint in a price war. If other firms respond with similar restraint, a tit-for-tat relationship may be initiated and become the basis for continuing cooperation. A fascinating example of signaling for mutual restraint during the Cold War was the cooperation between U.S. and Soviet naval forces to avoid collisions in times of high tension and close quarters. By using special signaling that announced present position and intent, the forces were able to avoid a competitive response.

Intraindustry cooperation can also take the form of forgoing competition for overlapping customers or developing product niches that would act as mutually recognized territories. Geographic territories emerge in this way, but these territories are not necessarily the product of intentional cooperation. They can evolve because competition is expensive and firms will avoid situations where the prize (a group of customers) is not worth the price it would take to get them. A firm will tend to concentrate more energy where competition is lower, until, over time, it finds itself selling more to certain markets or in certain geographic areas. Their dominance in these markets will then make other firms wary of coming into a market with a powerful, established competitor.

Intentional cooperation is obvious where competitors unite to obtain or defend a resource that no single member of the group could get on its own. For example, two competitors might make a joint bid on a contract that is too large for either alone to fill, or they might band together to induce customers, through, say, bid-rigging, to pay higher than market rates. Competitors have been known to band together to get a lower price for a commodity that all of them then use in their production process. Competing firms in an industry also form coalitions to fight off another

industry that threatens to take their customers or to fight government activities that threaten their resources.

Perhaps the most visible form of intraindustry (and sometimes interindustry) cooperation in the late twentieth century was joint efforts in research and development. Joint R&D, which granted each participant access to the same technology, was said to be *precompetitive*. Participants then used the new technology to compete with one another on price, features, and service. In these cases, the firms involved are not cooperating and competing at the same time for the same resource. The two modes are separated either by time or by the resource in question.

Firms in the same industry that would be expected to be intense competitors, sometimes come together in order to facilitate competition with a much larger firm or a new industry by offering their customers a substitute product. This kind of cooperation generally takes the form of sharing technical information, combining political strength, coordinating purchasing to get a better price, and cooperating in advertising and common signage. But small firms that continue to compete on the basis of quality and price at the retail level seem to assume that the increased fitness of the group confronting a large rival will not decrease individual fitness of each competing against the others within the group. This cooperation represents a sophisticated form of mutual restraint in a situation where an all-out contest would leave small firms vulnerable to the large one.

Any cooperation between firms can be expected to dissolve when individual members find that they can obtain more of the resource, suffer fewer government regulations, or achieve greater safety from a competing industry if they go it alone. If a cooperative group (such as a trade association) were to lose access to certain resources so that not all members could be given enough of the resources to sustain them, the strongest members of the group can be expected to leave in order to seek the resources on their own, even if their departure will decrease the fitness of the remaining members.

Cooperation between firms that is induced by government through tax credits or threats of regulation (“All of you get your act together or we’ll pass some regulation.”) is effective only as long as the benefit is useful or the threat is real. Firms are likely to ignore tax incentives if they have no profits to tax and to ignore regulation that they know government is incapable of enforcing.

Knowing these fundamental aspects of cooperation can help policy makers who want to discourage certain forms of intraindustry cooperation because they can use these fundamental forces to design policies that will not only make that certain cooperation illegal, but unlikely. For example, regulations could discourage firms from having contact with each other on a frequent or long-term basis by increasing each firm’s incentives to go it alone and by making sure that all firms can get the scarce resources they need without cooperation.

Implications for Regulation of Competition and Cooperation

Some policy makers and business leaders have occasionally asserted that competition and cooperation are natural processes, and therefore governments should not interfere with the natural selection of industry. It is difficult, however, to foresee a time when the industrial sectors of all countries would actually allow complete noninterference by government, because it would make many industries forgo the government protection from competition that they rely on.

Industries and firms can be expected to try to avoid competition through cooperation because competition will take resources away from activities for long-term fitness and reduce short-term return to owners. But some competition seems necessary to keep a firm or industry from settling too deeply into an equilibrium – a balance of forces from which it can't break free when new competitors appear.

The real winners of a competitive *contest* in the short to medium term are those peripheral to the competitors—that is, customers or suppliers—because *they* will be the scarce resource that is competed for. Any costs for this competition (lower prices to customers or higher payments to suppliers) must be paid for out of funds that otherwise would have been used for long-term activities and stockholder equity. Customers and suppliers are also potent political forces in most democracies (especially customers for consumer goods) and will have a large say in how much effort government puts into forcing competition that will benefit them.

But asking whether antitrust laws or ownership limits should be employed to stimulate competition is almost a purely academic question. They will be. The broader picture of competition and cooperation developed here can offer guidance for the policy course corrections that will almost certainly be necessary in the twenty-first century. For example, in a time when the established borders between industries are breaking down, a more useful definition of what constitutes a “market” will be critical in situations where interindustry competition begins to look like intraindustry competition. If several industries or several firms try to use the *exact same resource* only one will survive, particularly in networked industries. The definition of a communications “market” could thus be expanded to take into account all the industries that use the relevant scarce resource(s), such as the time and money of consumers for a particular type of communication product or service. This broader view will give policy makers a better chance to determine the probable rate of survival of all those industries. The “entertainment” market would then include film, video, TV, cable, satellite, print, and all other industries that compete for consumers' entertainment time and money.

A recurring policy debate in many nations centers on the definition of “competition.” Does it only mean an actual *contest* between two or more firms for customers? Or does the meaning include situations in which a contest is only theoretically possible (“contestable markets”) if government restraints and other barriers to entry are removed? Often it does not take into account the subtle (but often crucial) competition that resembles the *scramble*, when competitors weaken one another by using up critical resources but don't actively contest markets. Although biologists do not have one single definition of competition, most would include the following: (1) an interaction or active demand (2) for a shared requirement (3) that is a scarce resource, (4) leading to a reduction in the survival of one group of competitors. The fourth requirement is the most debatable: does competition require *losers*? That means that real competition is only a fleeting loss of equilibrium until the losers are pushed out (according to the competitive exclusion principle) and the winners take over the contested resource. Some governments may decide to focus their energies on finding ways to foster a stable, or sustainable competitive situations in which only a part of an industry's resources would be contested, thus making the survival of all contestants more likely.

Forcing Intraindustry Competition

The more two firms look like each other (that is, use the same resources), the more fiercely they will compete. Over time, the firm that can garner more of the scarce resource(s) will return more resources to its owners and attract more investment. The firms that attract fewer

resources will be seen as less fit and will not survive. The result of intraindustry competition is the culling of less fit firms. But competitors may try to increase their chances of winning by engaging in “spite” that will lower the fitness of all competitors (including themselves) until the weakest competitors die or leave the battle, through predatory pricing for example. Regulators are not always concerned about (or aware of) “spite” phenomena at the intraindustry level, even when it is undertaken intentionally. An established firm may do something that decreases its own fitness (such as put a supplier out of business) if the decrease in fitness would hurt their competitors more, particularly competitors who depend on that supplier for a greater percentage of their total resources. Regulators seeking to maintain competition may want to be careful in regulating all firms in an industry (or of several competing industries) in the same way in cases where that action would disproportionately decrease (or increase) the fitness of the individual firms and give others a competitive advantage that will eventually allow them to push others out of the market.

Firms that become engaged in fierce competition might also be inclined to do what some biological organisms do—allocate the resource in question by cooperation, rather than competition. They might agree to starve out another competitor by agreeing between themselves to deny it access to critical resources such as programming. They might also try to avoid competition by “signaling” their desire to end hostilities or just by avoiding overlapping customers. These strategies may or may not be intentional but they are likely to get the attention of regulators if they become apparent.

Regulators concerned about competition for residential services may want to consider that *contests* over territories occur only where a resource occurs in concentrations sufficiently large to make the territories worth defending. In competitive markets, telephone and cable companies are finding individual households extremely expensive to hang on to, and business services are more likely to be the locus of intense competition unless households can find a way to aggregate their demand in order to attract competing firms.

Forcing Interindustry Competition

Government attempts to encourage or maintain competition between industries can have both short term and long-term consequences. The former are often fondly anticipated in policy debates but the latter are seldom even discussed, perhaps because they occur over such a long period of time that cause and effect are difficult to see. As countries gain experience with introducing competition into the communications sector, the longer-term consequences of these policies will become apparent and may finally become part of the debate.

It is undeniably true that more interindustry competition can have real benefits for consumers (lower prices) and suppliers (higher prices), but this benefit is likely to be short term because competition makes winners and losers. The losers do not stay on the battlefield. Where several industries try to use the same resources the competitive exclusion principle will operate leaving only one winner. Introducing new competition will lead to adaptation by (or extinction of) incumbent players as they search for new resources. But this adaptive phase will last only until a new equilibrium is reached and/or the weakest industries have become extinct or left the market. Thus, although there may be increased competition in an environment of rapid technological or regulatory change, the competition may last only until “winners” become apparent and the system settles down again. The number of winners who remain in business will depend on how extensively their markets overlap. To the extent that each industry has other sources of customers (so they do not use *exactly the same* ones) they will be more likely to find a new equilibrium

where they can coexist. Government efforts to maintain long-term competition will take the extent of this overlap into account.

Industries in danger of losing a contest or a scramble for resources may look for a new niche in the market where they can live without life-threatening competition. Niches will become stable only if and when the market settles down again. If the market does not achieve stability, the industry will not be able to exploit the new adaptations it has developed and it will be in danger of falling prey to other industries from within the country and, increasingly, from industries entering the country under policies of free trade.

An industry that is losing resources to other industries would be expected to forgo intraindustry competition (at least temporarily) in favor of cooperation designed to fend off the new competition that threatens the entire group. In an industry that is losing access to critical resources, government policies that inhibit cooperation between firms run the risk of making these firms incapable of surviving to compete in the long term.

Many government efforts for increasing or maintaining competition between industries involve making sure that cooperation does not exist. These strategies will be more effective if:

- it is possible for one industry to invade the turf of another (short-term competition),
- long-term agreements are discouraged by law or tax penalties,
- contact between industries is infrequent, and
- very little “information” (e.g., product development or interoperability) is exchanged among industries.

Mergers and Acquisitions

When attempting to determine the acceptability of a merger or acquisition, regulators should not ignore competition in the form of the scramble (i.e., critical resources are used up by another firm or industry that may not be in a direct or immediate contest). An industry or firm losing some resource in a *scramble* (for example, access to inexpensive paper is lost to other forest products users) may become too weak to survive a *contest*. In order to survive, these firms may need to engage in cooperative activities. Sometimes merging with another firm is the only way to survive.

Regulators can take comfort from the knowledge that there is a limit on how large an organization or association can get. It will only hold together if, on average, the participants receive more than they would have by going it alone. If it cannot locate sufficient resources for all divisions of the firm, then it may break down into smaller firms. This was clearly evident in the U.S. with the break up of large firms such as ATT in the early 2000's.

Forcing Cooperation Between Competitors

Perhaps the most important idea we have seen in both biology and business is this: No two individuals or species (or two firms or industries) can cooperate and compete over the same resource at the same time. Competition and cooperation are different modes of action and cannot be undertaken simultaneously. Even the business consultant-cum-authors of the late 1990s who counseled companies to find ways to cooperate did not say to do so with competitors over the same resource. Instead, they urged cooperation with suppliers, customers, and competitors when these did not involve some resource both needed to survive.

This proposition has important implications for regulations that demand that some firms allow other firms access to their facilities (that is, to cooperate) so that the new firms can compete with them for customers. For example, phone companies are asked to offer competitors access to their infrastructure (not an unlimited resource) at prices that will allow a new competitor to offer service at or below the incumbent's price. A similar problem is presented by regulations mandating access to the wiring systems of cable service providers in apartment buildings for the benefit of competing cable and satellite providers. This type of regulation has proved extremely difficult and may be attempting the impossible. When firms must cooperate with respect to a scarce resource, allocation of that resource by competition may not be possible. It may be necessary to create a third party, such as a board or agency, to allocate access to the resource in question. This resolution would limit the competitive behaviors that interfere with the cooperation necessary to keep the system working.

Governments who want competing firms or industries to cooperate for other public goals will want to develop policies that encourage the four pillars of cooperation identified by Axelrod. For example:

1. A long-term commitment that is enforceable by both sides, usually by contract. This might include programs to improve the settlement of disputes outside the court system.
2. Frequent contact, in which the parties must either defect or cooperate (frequent meetings are not enough). Contracts with frequent "transactions" might get special tax considerations.
3. The training for all competitors so that they know what is really needed by everyone, and what they can give them that won't hurt their competitive positions.
4. An institutional memory outside the competitors that can remember who gave tit for tat.

Conclusion

It may be possible to make some tentative predictions about how competition will play out in the communications sector. They must be tentative because this is a very complex system and the forces at work on it (things like the economy, politics, and technological innovation) are not predictable. The new, broader abstractions for competition and cooperation that can be gleaned by looking at other systems can give us new ways to look at the troubling problems facing the business and regulation of communications around the world. Because they come from science (mostly biology and systems theory), these abstractions are not premised on any particular political or economic philosophy (although science has its own assumptions they do seem to cross cultures easily). It is hoped these ideas can become a basis for innovative discussions in many countries and at many levels of business and government.