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Nash Equilibrium

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Abstract

The concept of a Nash equilibrium is central to understanding the predictions of game theory. This article considers the applications of Nash equilibrium for the study of the theory of oligopolistic competition.

Definition A Nash equilibrium of a game is a set of strategies undertaken by agents such that no agent can improve their payoff by choosing another strategy, and taking the strategic choices of all other agents as fixed.

► game theory is a branch of applied mathematics that economists, and now researchers and practitioners in strategic management, have adopted to understand observed choices of firms and other agents in market environments. Central to the predictive power of game theory is the identification of equilibrium outcomes – or solution concepts – in game representations of strategic environments. The primary concept of equilibrium employed for this purpose is the Nash equilibrium. An 'equilibrium' is usually defined as a point of rest. A point of rest in a game is naturally defined as an outcome with no tendency for change. As changes in games are brought about by changes in the strategic choice of agents playing a game, it is natural to match the equilibrium of a game with the tendency of agents to believe that they cannot improve their own payoff by changing their strategies. The Nash equilibrium provides the most direct means of making that evaluation.

We provide a historical overview of the concept of Nash equilibrium before turning to its formal definition. We then examine refinements that have allowed researchers to focus attention on particular Nash equilibria with distinct and potentially more natural properties. Finally, we review the use of Nash equilibrium in modelling oligopolistic behaviour.

Brief Historical Overview

While the concept of the Nash equilibrium was first formally stated and analysed by John Nash (who shared a Nobel Prize in economics for this achievement in 1994; see Nash 1950, 1951), the concept was originally applied by Antoine Augustin Cournot in 1838. Cournot considered two firms who were faced with the choice of the quantity of output to supply in a market. These choices interacted with an increase in one firm's output, changing market price, and, with it, the margins the other firm would earn by producing more. To sort through this interaction, Cournot looked for an equilibrium point where each firm was choosing the output that maximized its own

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profits on the assumption that the output of its rival was fixed. Then, taking the conditions for maximization and ensuring that they were reconciled – that is, that one firm's assumption of the other firm's output matched the choice that firm would actually make (in mathematics, formally, looking for a fixed point) – Cournot found the equilibrium levels.

Nash's contribution was to modernize Cournot's approach for the new mathematical theory of games as exposited by John von Neumann and Oskar Morgenstern (1944). These authors had noted that strategies of agents in a game might be pure or mixed. The latter involved a randomization over a set of actions that might be chosen by a player. They showed that for zero-sum games (where one agent only wins at the expense of another), an equilibrium existed in either pure or mixed strategies. Nash was able to demonstrate this existence for general games (both zero and non-zero sum).

Formal Definition of a Nash Equilibrium

To formally define a Nash equilibrium, one must start with a game. A game is comprised of a set of agents, N, with element n, and for each agent, n, they have a set of strategies X_n from which they can select one x_n; although that can select a randomization over those strategies as part of a strategy profile. For a given set of selected strategies, $\{x_n\}_{n \in N}$, each agent, n, receives a payoff π_n (x_n, x_{-n}) where x_{-n} is the set of selected strategies of agents other than n.

Games can have different forms. In some, each agent chooses her strategy after observing some of the strategies of other agents (i.e., sequential move games). In others, agents never observe some of the strategies of other agents (i.e., games of incomplete information). In still others, agents never observe any of the strategies of other agents before committing to their own. These final games are called simultaneous move games.

In a simultaneous move game, a pure strategy Nash equilibrium is a set of strategies, x_n^* for each agent, n, such that:

$\pi_n\left(x_n^*; x_{-n}^*\right) \geq \pi_n\left(x_n; x_{-n}^*\right)$ for all n and for all $x_n \neq x_n^*$.

A Nash equilibrium that allows for mixed strategies is defined analogously but with expected payoffs over potentially randomized strategy profiles. The formal definition captures the notion that a set of strategies is an equilibrium if, holding the strategic choices of other agents as fixed, no agent prefers an alternative strategy.

Types of Nash Equilibrium

There is rarely a unique Nash equilibrium in a game. This is especially true of sequential move games and games with incomplete information, but can also be true of simultaneous move games. In some situations, that multiplicity of equilibria represents an interesting prediction of games. For instance, Thomas Schelling (1978) demonstrated this with respect to coordination failures, which has since been applied in strategic management to understand network effects and platform strategy (see, e.g., Shapiro and Varian 1998).

In other situations, the multiplicity of Nash equilibria arises because the concept of Nash equilibria has too little structure to identify more plausible equilibria. In sequential move games, this arises when a Nash equilibrium outcome of a game involves a strategy that comprises a threat that is not credible. For instance, an incumbent in a market may want to play a strategy that involves setting a very low price (perhaps below marginal cost) should an entrant incur sunk costs to enter the market. There is often a Nash equilibrium in such games that involves the entrant not entering as a result of a forecast of that low price. However, the incumbent's pricing threat may be non-credible in the sense that, should an entrant actually enter, the incumbent might no longer find it worthwhile, from that point on, to price low. If the entrant sees through this, the entrant will enter, and the unique equilibrium outcome will involve the entrant entering and the emergence of competitive pricing. Reinhart Selton (1975) studied this problem and developed a refinement to Nash equilibrium termed *subgame perfect equilibrium* to

require that all threats (and indeed promises) in sequential move games be credible.

Modelling Oligopoly

In strategic management, Nash equilibrium is applied wherever game theory is used. This is particularly the case when it comes to modelling the behaviour of oligopolistic firms. As noted above, a natural way of modelling such firms comes from assuming that they can commit to quantities leading to a Cournot Nash equilibrium. However, it can equally be the case that competing firms can be modelled as competing on price. This leads to a Bertrand equilibrium outcome (usually involving price at short-run marginal cost or with a mark-up when there is some product differentiation). But the choice between them is not always a free one and can relate to the underlying characteristics of the industry (Ghemawat 1997). In addition, the type of strategic variables that are the focus of competition can also impact on strategic incentives to engage in other activities (e.g., advertising, R&D and entry); see Fudenberg and Tirole (1984). This has meant that significant care must be taken when applying game theory to generate predictions for empirical testing (Sutton 1991).

See Also

► Game Theory

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Natural Monopoly

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Abstract

This entry covers the role of natural monopoly in strategic management. Following a brief historical overview, a formal definition is provided that focuses on industry production characteristics. How the presence of natural monopoly characteristics impacts competition is addressed, along with the implications for strategic contracting, especially in technology markets.

Definition A natural monopoly is a characteristic of an industry or market whereby a single firm achieves the lowest production costs over all output in the feasible range of demand.

A monopoly describes a situation where all (or most) sales in an industry or market are undertaken by a single firm. A natural monopoly is a characteristic of an industry or market whereby it is most efficient (that is, involves the lowest production costs) for a single firm to be responsible for all production in that industry. Consequently, the condition for a natural monopoly is a technological characteristic of an industry or market rather than a description of its observed market structure. Monopolies can exist in industries that

are not natural monopolies, and monopolies may not arise in industries that are natural monopolies.

In the context of strategic management, a natural monopoly relates to the ability of established firms to compete on price and scale and to prospects for successful entry. When an industry is characterized as a natural monopoly, it can generate a ▶ first-mover advantage whereby a firm who makes an initial large-scale investment in an industry may be protected from further competition.

Brief Historical Overview

The concept of natural monopoly arose as economists tried to understand the presence of monopoly in certain industries and its efficiency (Sharkey 1982; see Mosca 2008, for an overview). While monopo-lists tended to raise prices above competitive levels, in some industries it was difficult to conceive of their being more than a single firm. Classic examples included rail and transport networks, communication and postal networks, and utilities involving large sunk costs. This difficulty in conceptualization was related to the prospects of entry. The French economist Jules Dupuit argued that transport monopolies could be sustained because any entry would have to be on a large scale. Specifically, even if successful, entry would divide consumers across firms, making it difficult for them together to earn enough revenue to cover their duplicated fixed costs. He wrote: 'instead of one good business, there will be two bad ones' (Dupuit 1852–1853: 340). John Stuart Mill (1848) described related notions while the concept was refined by Richard T. Ely and colleagues (1919).

Eventually, the concept of natural monopoly became closely tied to the presence of ▶ economies of scale and scope. A production process exhibits scale economies if long-run average costs fall over the feasible range of production. In this situation, it would be efficient for all demand in an industry to be supplied from a single production process. However, it was well known that to confer a monopoly position on a firm does not necessarily generate an efficient outcome. Consequently, the condition of a natural monopoly became cited as a source of market failure, requiring government intervention to prohibit entry into an industry as well as to regulate the incumbent firm to prevent the exercise of monopoly power. This was a view exposited by Francis Edgeworth (1911).

Formal Definition of a Natural Monopoly

William Baumol (1977: 810) provided the current formal definition of a natural monopoly: '[a]n industry in which multiform production is more costly than production by a monopoly'. He linked the definition to the mathematical concept of sub-additivity; specifically of the cost function. Consider a cost function, $C(q_1, \ldots, q_n)$ where q_i are the quantities of n distinct product outputs. $C(.)$ is said to be sub-additive if, at a given output level, $\overline{q}$,

$$C(\overline{q}) < \sum_{i=1}^{n} C(\overline{q}_i)$$

where

$$\sum_{i=1}^{n} \overline{q}_i = \overline{q}$$

with at least two components where $\overline{q}_i > 0$.

Baumol also noted that for a firm producing a single profit scale economies were a sufficient but not a necessary condition to prove sub-additivity. Baumol and various others refined and expanded on this notion (Baumol et al. 1977, 1982).

While establishing whether production in an industry is characterized as a natural monopoly can be difficult, in industries with significant fixed or sunk costs and low or constant marginal costs of production, the condition can be satisfied. Note that the natural monopoly condition is a condition relating to the costs of production and not demand. For instance, network externalities, by which the value of a product sold by one firm to a consumer is rising in the amount of purchases or consumers that firm has, is a reason why an industry may tend towards a monopoly and may even operate efficiently as a monopoly. However, this is

typically a distinct condition for monopoly from those determining a natural monopoly.

Competition and Natural Monopoly

If an industry or market is characterized as a natural monopoly this does not necessarily imply that a monopoly will emerge in an industry. However, there are conditions under which the emergence of a monopoly is more likely.

Consider an industry that produces a single homogenous product for which there are no substitutes. Also, suppose that production in the industry involves economies of scale. In this situation, if firms in the industry choose price as their main strategic variable (or cannot commit to restrict quantity), then the equilibrium in the industry involves a single firm. To see this, note that because the product is homogenous, all sales accrue to the firm charging the lowest price. If two or more firms are charging that low price, then any one of them can gain all sales in the industry by setting a slightly lower price than their rivals. Because long-run average costs are falling, if firms were not making losses prior to the price cut, the price-cutting firm will still make profits following that cut. It is only when there is a single firm pricing at long-run average cost that no further price cuts are profitable (Panzar and Willig 1977).

This monopoly outcome is not necessarily inefficient because the price charged by the monopolist is constrained by competition. In a broader context, this situation is described as a perfectly contestable market. This occurs when a firm operating in a natural monopoly market is constrained to price at long-run average cost by potential competition from rival firms who may be entrants. If that firm should raise its price, another firm could enter and undercut it. Thus, the presence of a natural monopoly is no theoretical constraint on competitive outcomes emerging.

In reality, there are reasons to suppose that this ideal outcome will not arise in practice. Small frictions can enable economies of scale as an entry barrier. Dasgupta and Stiglitz (1988) demonstrate that if entry involves an arbitrarily small, sunk cost or exit involves such costs, then an entrant could not expect an incumbent to maintain its pre-entry prices. Instead, prices will fall to short-run marginal cost. When there are economies of scale, this means that both firms will be making losses and, in the long run, will not recover sunk costs of entry or exit. Anticipating this, entry will not occur and a monopoly with prices unconstrained by competition will persist. In some variants of this story, a war of attrition (Bulow and Klemperer 1999) occurs whereby a period of intense competition arises post-entry with a monopoly re-emerging thereafter. Nonetheless, it is generally considered that in industries characterized by a natural monopoly a firm that can quickly produce at scale can achieve a first-mover advantage that will be a source of persistent profitability thereafter.

It is also possible that a monopoly will not arise, whether efficient or not, even when an industry is a natural monopoly. Transport costs or some product differentiation may allow a diverse range of firms to enter with a variety of products. In situations where entry barriers involve fixed but not sunk costs, a monopolistically competitive outcome can emerge (Dixit and Stiglitz 1977). Such models have been the foundation of new economic models of international trade, geography and growth.

Entry can also occur when the consequence of entry is to cause incumbent firms to scale back on output rather than to expand it. Mankiw and Whinston (1986) demonstrate that as an entrant 'steals the business' of incumbent firms, the optimal response of those firms is to adjust their output downwards rather than to reduce price to reclaim that business. This occurs, for instance, if post-entry competition is characterized by Cournot, or quantity competition, rather than Bertrand, or price competition. However, it is not limited to that distinction. Mankiw and Whinston demonstrate that such entry is socially inefficient, raising industry production costs in a market that satisfies the conditions for a natural monopoly. Gans and Quiggin (2003) demonstrate a similar effect under conditions of price competition when entry can occur at a small-scale – say, by entrepreneurial firms with limited managerial capacity.

Contracting and Natural Monopoly

In an industry characterized as a natural monopoly, unless the conditions for perfect ▶ contestability are satisfied, there is no guarantee that the most efficient firms will end up producing. This is particularly the case when the natural monopoly is covering multiple products but another firm is potentially more efficient in producing one of those products, or when the capabilities to produce are distributed across firms.

In this situation, the notion that all production takes place under the control of a single firm has been challenged. Teece (1980) argued that when the capabilities to produce different products are across firms but there are economies of scope in their production, contracting across firms may realize those synergies if transaction costs are not prohibitive. Thus, a monopoly need not arise even if the industry has natural monopoly characteristics. Similarly, Teece (1986) argued that, in the specific case, where ideas for new products come from firms who do not possess the ▶ complementary asset to generate value from them, contracting or licensing can be used to ensure synergies are realized. Gans and Stern (2003) developed this concept further to explore the strategic issues facing entrepreneurial firms in commercializing ideas in industries characterized by a natural monopoly in key vertical segments.

See Also

- ▶ Complementary Asset
- ▶ Contestability
- ▶ Economies of Scale
- ▶ First-Mover Advantage

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Natural Selection

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Abstract

In this entry the contemporary scientific usage of the selection concept is explained and a formal definition provided. This concept of selection

covers both selection processes taking place in markets and inside the firm. It also covers all known forms of selection in nature. The concept of selection is elaborated with an emphasis on selection processes in strategy research. Strategy research typically views selection as an error-prone adaptive process that operates on multiple levels of organization. Industry-wide selection processes trickle down and influence firm-level expansion and contraction of particular resources and capabilities. These processes do not reliably discover optima.

Definition Natural selection refers to a change in the distribution of a population property such as the size of firms in an industry. Selection involves an anterior set of entities (e.g., small firms) that is transformed into a posterior set (e.g., large firms) where the resulting distribution depends upon the entities' properties in the environmental context (technical fitness values).

Selection would seem to be a fundamental driver of differential success in strategic management. Differential alignment of business strategies to the external selection environment provides differential rewards to organizations. Firms with mistaken strategies will lose to those who have better strategies. Failing firms contract; their routines become unstable and lose weight relative to other routines present in the industry. In contrast, successful firms expand while their routines become stable and gain in weight relative to other routines. As differential rewards lead to expansion and contraction of firm operations, selection causes a shift in the industry-wide distribution of firm size. This portrayal of industry dynamics as a selection process, driven by adaptive experimentation, is well established in the economics of strategy. Landmark contributions include Klepper (1996), Lippman and Rumelt (1982), and Nelson and Winter (1982).

Because firm-level actions leverage the firm's resources and capabilities, selection in the market is linked to selection processes inside the firm (Burgelman 1991; Lovas and Ghoshal 2000; Zollo and Winter 2002). Differential alignment of resources and capabilities to the internal selection environment provides a basis for promoting and demoting business policies, resources and capabilities. In effect, selection processes taking place inside the firm can lead to expansion and contraction of particular resources and capabilities. This perspective is not quite as well established as industry-level conceptions of selection. A number of issues remain unsolved, including the critical task of disentangling development and selection processes.

There is a long history of treating economic change as a selection process (Alchian 1950; Winter 1964). A common idea is that the selection process converges to optimal outcomes. Managers would then seem to act as if they played out the predictions of textbook economics. For several reasons, this is not a compelling argument in strategy research. The selection processes in strategy are relatively complex, operating at multiple levels of organization (within and between firms), and involving multiple interdependent selection criteria. Errors creep in so that the selection process becomes inefficient in the sense that it has multiple equilibria and does not reliably discover optima.

Strategy research typically views selection as an error-prone adaptive process that operates on multiple levels of organization. These processes are quite complex, but the concept of selection has not yet evolved much beyond its common usage. In common usage, selection is synonymous with choice, connoting the act of selecting, as in the selection of a new manager to fill an open position. In contrast, the scientific usage of selection has a very precise meaning, referring to a change in the distribution of a population property (a set of traits) such as the capabilities of firms in an industry.

Two very different concepts of selection are employed in science, and both are encompassed by its general mathematical definition (Price 1995). One meaning can involve the selection of a subset of elements from a set. Examples include the selection of a subset of prey that survive a predator's attack or the selection of a subset of firms that survive an industry shakeout. Price (1995) termed this subset selection. Subset selection is very different from the concept of generative selection where offspring are not subsets of parents. Generative selection involves reproduction, whereas subset selection is a simple elimination process.

Subset Selection

Consider the following example of subset selection in nature (Landa et al. 1999). There is an anterior distribution of speed in a population of reindeer. A wolverine slays a number of the reindeer. In consequence, the distribution of speed in reindeer is transformed into a posterior set. If the slowest die, there is a significant and positive selection for higher average speed in reindeer. However, subset selection could as well occur because an avalanche eliminated reindeer at random. A similar argument holds for subset selection on firms. Subset selection can alter the value of a population property when some properties of firms remain stable, such as their routines. For example, business ventures that are eliminated because of bankruptcy are a common instance of subset selection (Katz and Gartner 1988).

Subset selection is here defined as one cycle of environmental interaction and elimination of entities in a population, so structured that the environmental interaction causes elimination to be differential. Evolution happens because of repeated cycles of subset selection. Each cycle of subset selection eliminates variation. In a formal description, subset selection is a contraction mapping. Each cycle of subset selection contracts the anterior set, yielding a posterior set with fewer elements than the anterior set. Eventually, after many cycles of subset selection, the anterior set only contains one remaining member of the population – or it may even become an empty set. Subset selection will eventually run dry of variation and come to a halt.

Surprisingly, many population processes in nature and at the social level involve subset selection. Molecules, cells, plants, moths, reindeer and tigers are biological populations whose properties are altered by subset selection. Hard winters, hot summers and various natural catastrophes commonly eliminate organisms. Similarly, institutions, social organizations and human individuals are social populations whose properties are altered by subset selection. Since the contemporary scientific usage of the selection concept encompasses processes in nature and society, it is no longer useful to uphold a distinction between natural selection and other forms of selection involving human choice.

In cases where the selection criterion is located at the physical or biological level, such as earthquakes, subset selection does not involve choice and preference. However, when the selection criterion is located at the social level, human choice and preference is always somehow involved, even if indirectly. A common instance of subset selection at the social level is the elimination of firms through bankruptcy. Weak technical efficiency, wanting market orientation, a reputation for dishonesty, a lack of institutional support, inadequate business models, inefficient production processes, unattractive product portfolios and ineffective internal organization often lead to bankruptcy (Aldrich 1999; McMillan 2002). In such cases, choices and preferences are involved in some way because it is the deliberate choices of managers that lead to failure. However, the selection outcome overall may not itself be a direct reflection of the discrete decision of a single person or group.

Often, the selection criterion operating on firms comprises a complex of environmental factors; it becomes a composite weighted measure. Further complications are introduced by considering the environment as endogenous to the selection process. Powerful (groups of) entities can sometimes change the selection rules. The matter is further complicated because selection of firms is a process operating at multiple interdependent levels. Even though such complications introduce both multiple, recursive and nested components in the selection criterion (fitness function) – thus complicating the unique identification of the causes of a change in a population property – they can readily be accommodated in the modern selection formalism (see formal definition below).

Generative Selection

Generative selection can be defined in the following way (Hull et al. 2001): one cycle of

replication, variation and environmental interaction so structured that the replication process causes new variation (i.e., new varieties alter the distribution of the population property) and the environmental interaction causes replication to be differential. In contrast to subset selection, generative selection can accommodate an explanation of how new variation is created. Because of reproduction error (mutation) and genetic recombination, offspring can have new properties that differ from those possessed by their parents. More generally, whenever replication processes produce imperfect copies, generative selection produces new variation. The concept of generative selection seems promising for understanding processes of self-expansion that are critical in strategic management (Lippman and Rumelt 1982). But the details are yet to be worked out.

Formal Definition of Selection

The terminology introduced by Price (1995) yields a useful statistical definition of selection. Let P be a set containing ω_i amounts of I distinct elements which have the properties x_i. A transformation $P \rightarrow P'$ (possibly the identity transformation) results in a second set P'. The set P' contains ω_i' amounts of I distinct elements with properties x_i'. The transformation $P \rightarrow P'$ is termed a selection process that gives rise to the effect $X \rightarrow X'$ in a population property X related to property x of the individual set members. This effect $X \rightarrow X'$ can be calculated as the change in the average value (Price 1995; Frank 1998):

$$\Delta X = X' - X = \sum \omega_i' x_i' - \sum \omega_i x_i$$
$$\Rightarrow e\Delta X = Cov(e_i, x_i) + E(e_i \Delta x_i), \omega_i' = \omega_i e_i / e,$$

where e_i is the fitness of element i in the set P and e is average fitness of the set P. Selection is present whenever $Cov(e_i, x_i)$ differs significantly from zero. By contrast, a transmission effect is present whenever $E(e_i ?x_i)$ differs significantly from zero. In strategy, a transmission effect can be referred to as an individual-level exploration or innovation effect.

The formalism presented here provides a useful solution to the definition and empirical verification of possible selection effects. As the reader can verify, it is straightforward to recursively expand the above expression to include multiple hierarchical layers of selection (use the expectation term for expansion).

See Also

▶ Evolutionary Theory of the Multinational Corporation

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Negative Knowledge

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Definition Negative knowledge is awareness of what not to do or of paths to avoid. Such knowledge often results from direct experience.

Negative knowledge is one of the two types of learning that an individual or organization acquires from experience. Whereas the focus of most experiential learning is typically on discerning 'what to do', it can be heuristically valuable to take note of what not to do (Minsky 1994; Gartmeier et al. 2008). Negative knowledge is thus a form of learning about actions and paths to avoid, typically learned from one's own (or from others') mistakes. Negative knowledge is sometimes defined more broadly. Parviainen and Eriksson (2006) identify four features of 'negative knowing': to know what one does not know; to know what not to do; unlearning and bracketing knowledge; and failures and mistakes. The second and fourth are clearly linked to the definition used in this entry. The other two add an understanding of the scope of the knowledge needed by individuals or organizations to achieve their goals.

Negative knowledge is a type of metacognition involving knowledge *about* strategies and about the conditions under which they will be effective (Pintrich 2002). The possession of negative knowledge reduces the uncertainty surrounding the choice and execution of a strategy.

Knowledge of a strategic or technological 'dead end' can be a valuable asset, allowing one to economize on future efforts in innovation or strategy formulation by eliminating those that include the known blind alley. Knowledge of past failures ('this approach doesn't work') can help steer resource allocation into more promising avenues (Teece 1998, 2000). For this reason, and putting issues of embarrassment aside, firms often find it desirable to keep their failures as well as their successes secret.

Negative knowledge is initially accumulated by individuals. Studies suggest that how organizations manage the negative knowledge of their employees affects performance. In particular, organizational 'error management cultures' that encourage communication about errors and their rapid detection, analysis, and correction are associated with better outcomes (van Dyck et al. 2005).

Likewise, the steps needed to steer groups away from erroneous paths may need to be conceived and implemented at a group, rather than an individual, level (Edmondson 2004). This is particularly important in circumstances of interactive complexity that have multiple, non-linear causal linkages (Perrow 1984).

See Also

► Tacit Knowledge

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Nelson, Richard R. (Born 1930)

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Abstract

Richard R. Nelson (b. 1930) is an American economist who has had a significant influence on the field of strategic management. The fundamental question driving his work is how societies can be organized to improve their material well-being. In answering this question, Nelson identifies sustained technological ▶ innovation and a diverse range of often industry-specific institutional structures as the key engines of economic growth. He sees business firms as playing a key role in the growth process because firms are the carriers of the knowledge and abilities required to produce the complex product and services that characterize modern economies.

Richard R. Nelson is an American economist whose principal aim has been to develop a deeper understanding of ▶ technological change and economic growth. His career-spanning work on technological change (e.g., Nelson 1962, 1993) has shaped scholarly thought in economics and many other fields. In the field of strategic management, Nelson has wielded strong influence on the study of ▶ innovation and how firms develop. This influence is based in large part on the landmark book that he and ▶ sidney winter published in 1982 under the title *An Evolutionary Theory of Economic Change*. As of May 2012, the book had received approximately 6000 Web of Science citations and 23,000 Google Scholar citations, making it one of the foundational texts in strategic management. The book has had such a strong impact on the field of strategic management for several reasons: first, it builds on the carnegie school's (Cyert and March 1963) influential notion of routines as the key building block for organizational decision-making. Second, it offered a coherent theory of how firms and industries acquire capabilities through an evolutionary process that, of necessity, involves innovation and a substantial degree of trial and error. In explaining the sustained competitive advantage of individual firms there are two broad traditions. The first one points to favourable external market structures and the second to resources lying inside the firm that are difficult to trade, imitate and replicate. Nelson and Winter (1982) combine these traditions in their evolutionary view of capability development where markets select out those firms that do not have sufficient capabilities to compete.

Nelson's long-term research on innovation (e.g., Nelson et al. 2006), intellectual property rights (e.g., Levin et al. 1987) and the larger institutional environment (e.g., Nelson 1993; Nelson and Sampat 2001) in which innovative activity takes place has also been very influential in strategic management because his ideas help explain how firms gain and lose competitive advantage.

Knowing a few details of Nelson's biography can help to provide a better understanding of the intellectual trajectory of his work. He grew up in Washington, DC, in a family headed by a government economist who was trying to help the US economy get back on track in the wake of the Great Depression. After completing high school in the US capital (Winter 2000), Nelson went on to study at Oberlin College in Ohio, a private liberal arts college, which has long been associated with progressive causes. He received a bachelor's degree from the college in 1952 and then went to Yale, enrolling in the Ph.D. programme in economics. By today's standards the 'science of economics' as implemented in the curriculum of the Yale Ph.D. programme was conceived broadly. It included, for example, economic

history as a required field of study. Nelson (2003b) explains:

> The orientation to economics as a discipline at Yale was very much that the goal of the subject was the understanding of real empirical phenomena, and that an important use of that understanding was to guide policy making to improve the human condition. Good economic theory was an important aspect of that understanding. But it was not all of that understanding; a good economist also ought to know a considerable amount of economic history, be a good empirical analyst, and also have a strong common-sense understanding of the economic world.

Nelson completed his Ph.D. thesis in just 3 years, being awarded a Ph.D. degree in 1956. He had become convinced that technological advance was the key factor driving economic growth (Nelson 2007) but realized that he knew too little about technology. Taking advantage of a scholarship programme offered by the US government, Nelson then enrolled in undergraduate engineering and science courses at MIT to complement his Ph.D. training in economics and he subsequently worked for a decade at the ▶ Rand corporation, focusing on policy questions related to the organization of innovation and national security. Nelson (2003b) later described the research ethos at RAND as follows: 'While methodological rigor was required, the researchers knew that their principal task was to get the problem right, and to illuminate real solutions to the real problem.' This means that both his graduate student days at Yale and the decade at RAND, which was interrupted by a stint on the Council of Economic Advisors in Washington, during the Kennedy administration, solidified Nelson's approach to research, focusing on explaining real problems. In 1968, Nelson left RAND to become Professor of Economics at Yale University and in 1986 he moved to Columbia University where he is currently Professor Emeritus and Director of the Center for Science Technology and Global Development.

For Nelson the central 'real' problem is to understand how society can bring about economic growth. When Nelson began his career as an economist, evidence had emerged that economic growth historically was not simply a matter of adding more labour or capital into the economy. Long-term data series on the US economy had shown that increases in productivity were at the core of economic growth and that only a small amount of this growth of output per worker was due to increased capital use per worker. This meant that technological change was likely playing a central role in productivity increases that allowed the average worker to generate ever larger amounts of goods and services (Nelson 1962). For an economist interested in economic growth, the key questions therefore become: What is the optimal rate of investment in innovative activity? To what extent should the government be involved in funding and organizing innovative activity? And how should policymakers trade off the potential benefits of encouraging innovation through ▶ patents and the costs of granting temporary monopolies with patents?

To provide better answers to these questions, throughout his career Nelson mixed theoretical and empirical analyses. In an early paper (Nelson 1959), Nelson showed, mainly through theoretical analysis, that basic R&D has the classic externality problem and that, for this reason, profit-seeking firms would underinvest in basic science since they would not be able to fully capture the returns from such investment. To provide a deeper understanding of the relationship between basic and applied research, Nelson next investigated how economically important new technologies such as the transistor actually came about (Nelson 1962) and how new technologies, diffused throughout the economy, lifted overall productivity levels (Nelson 1968). One central conclusion that Nelson reached by comparing technical change in the agricultural, medical and aircraft sectors is that the nature of the innovation process and the organizational and institutional factors facilitating it differed from sector to sector across the economy (Nelson and Winter 1977).

A basic fact about technological innovation highlighted early on in Nelson's work (1959) is the inherent uncertainty involved in the process of innovation: ahead of time actors do not know which research efforts will yield great results and which will be a waste of time. This means that the only way to arrive at effective solutions is to carry

out parallel experiments and reallocate resources as more is learned about the relative merits of alternative solutions (Nelson 1962). The strength of capitalist economies is precisely that competing firms engage in a parallel search for new products and new ways to make them (Nelson and Winter 1977). In Nelson's theoretical writings, the diversity of firm capabilities and strategies are a fundamental engine of progress precisely because no one can predict in advance which strategy will turn out to be most effective (Nelson 1991).

Nelson's influence in strategic management is based in large measure on being able to construct a theoretical explanation for how firms are able to develop the capabilities to organize the often exceedingly complex research, development and production processes that characterize modern economies (Dosi et al. 2000) where increasingly sophisticated products and services sweep away old ones (Nelson and Winter 1977). Just how sophisticated the capabilities of firms are that can turn out such products as the modern commercial aircraft or notebook computers comes into full view when we remind ourselves of the limited abilities of a single individual human being (Nelson 2003a). The theoretical structure unifying Nelson's work on technological, corporate and industrial change is evolutionary theory. Modern technologies and firms come about through a combination of three processes: an inheritance mechanism that conserves already accumulated accomplishments; a variation mechanism that tries out multiple novel approaches; and a selection mechanism that identifies the more effective ones (Nelson and Winter 1982). The explanatory power of this approach has been shown in many empirical studies of firms and industries (e.g., Mowery and Nelson 1999; Murmann 2003) and led to Nelson's influence.

Nelson's scholarly impact is due, in part, to his skill in organizing research projects in which he enlisted leading scholars to collaborate on an important topic and create a product that was much better than would have been produced if the scholars had worked in isolation. The most celebrated examples of this leadership skill are the volumes on *The Rate and Direction of Inventive Activity* (Nelson 1962) and on *National Innovation Systems* (Nelson 1993).

Through both his writings and extensive personal interactions, Nelson has also had a direct influence on many other strategy scholars who, in turn, have had a large impact on the field. For example, David Teece's ideas on how firms can appropriate returns from innovation (Teece 1986) and on dynamic firm capabilities (Teece et al. 1997) owe a great deal to Nelson. Helfat's publications on dynamic firm capabilities (e.g., Helfat and Peteraf 2003) are building on the foundations laid by Nelson and his frequent collaborator Sidney Winter. The same is true of Kogut and Zander's (1992) work on capability replication as well as the work of a large number of other innovation and strategy scholars.

See Also

- ▶ Industrial Organization
- ▶ Innovation
- ▶ Organizational Routines
- ▶ Patents
- ▶ Path Dependence in Technologies and Organizations
- ▶ Rand Corporation
- ▶ Science Policy
- ▶ Winter, Sidney G. (Born 1935)
- ▶ Tacit Knowledge
- ▶ Technological Change

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Network Effects

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Abstract

Network effects are a key economic and strategic phenomenon in 'new economy' industries. They can, but do not necessarily, lead to market tipping, unless they outweigh customers' benefits from differentiation *and* are accompanied by high switching and multi-homing costs. Network effects create the possibility for multiple equilibrium market configurations, which are crucially determined by market participants' expectations. While in some markets network effects are exogenously given, in other markets their existence and magnitude is endogenously determined by firms' strategic choices.

Definition Network effects arise when the value a customer derives from a good or service grows as other customers adopt compatible products.

Network effects arise when the value a customer derives from a good or service grows as other customers adopt compatible products (Katz and Shapiro 1985). There are two types of network effects: direct and cross-group. Direct network effects emerge when each customer's *utility* increases with the number of other customers who use the same product or technology. Here, utility is gross of the price paid (if any). This is meant to rule out the 'pecuniary effects' criticized by Liebowitz and Margolis (1994), that is, effects operating solely through price (more participants leading to lower prices, hence benefiting existing participants). Examples of direct network effects include fax machines; instant messaging services such as AOL, MSN, Yahoo!, or QQ in China; and social networks such as Facebook and LinkedIn.

Cross-group network effects occur when there are at least two different customer groups that are interdependent, and the utility of at least one group grows as the other group(s) grow. The

most obvious examples are game consoles, which become more valuable to consumers with the emergence of gaming applications; or operating systems such as Windows or Android, which grow in utility with the growth of applications. Conversely, the utility derived by developers of games or operating system applications grows with the growth of end-users. Cross-group network effects also exist between buyers and sellers on eBay; content providers and end-users in VCRs and high-definition DVD formats such as Blu-Ray; merchants and consumers for payment systems such as Visa, American Express and PayPal.

The academic literature on network effects was pioneered in economics by David (1985), Farrell and Saloner (1985, 1986), Katz and Shapiro (1985, 1986) and Arthur (1989). Most of the early literature focused on direct network effects and used the term 'network externalities'. Network effects were also sometimes known as demand-side ▶ economies of scale. They are the counterpart of supply-side economies of scale, which occur when the average cost of producing an additional unit is decreasing in relation to the total number of units produced, or when the quality of an additional unit is increasing in relation to the number of units produced. Many 'traditional' industries exhibit supply-side economies of scale (e.g., car and steel manufacturing), but few of them have network effects. In contrast, network effects are pervasive in 'new economy' industries, particularly information and communication technologies. Some of them exhibit both supply-side economies of scale *and* network effects (e.g., operating systems such as Google's Android and Microsoft's Windows).

While economies of scale are inherently bounded, network effects can exhibit increasing returns. The average production costs of most physical products decrease until capacity constraints require the building of a new plant, which leads to a sharp increase in average costs. For digital products (e.g., Windows), they can go to zero, but no lower. In turn, while any user's willingness to pay for Windows eventually stops increasing (after 10 or 20 or 100 software applications), the profits of third-party application developers can increase without bound with the number of Windows users.

Market Tipping

For strategic management, the importance of network effects is the possibility that markets *can* 'tip', that is, lead to the outcome in which only one technology, product or service emerges as the clearly dominant player while others are marginalized or even disappear (Shapiro and Varian 1998). Indeed, network effects generally imply that there is value for users to coordinate on adopting the same technology or platform. But not all markets with network effects will tip. Three additional conditions are necessary for tipping to occur: (1) the value of the network effects must outweigh the benefits of differentiation for users; (2) users must have high 'multi-homing' costs (i.e., the costs of adopting two or more technologies – see Crémer et al. 2000); and (3) users must have high switching costs (i.e., the costs of abandoning one technology in favour of another). If any of these three conditions fail, multiple technologies with significant market shares may coexist. For example, despite strong direct network effects, the instant messaging market in the United States remained an oligopoly (MSN, AOL, Yahoo! all have market shares larger than 20%) for 15 years, mainly because it was very easy for consumers to use multiple instant messaging accounts simultaneously. In contrast, the PC operating system market tipped to Windows in the early 1990s, in part because of the high switching costs to move between alternative platforms (PCs and Macs), and because of the multihoming costs for application developers, which led to a high barrier to entry, favouring Windows.

Finally, when markets with network effects do tip, this is not a guarantee of permanent success. Both external and internal shocks can cause markets with strong network effects to atrophy (Cantillon and Yin 2010). New technologies (mainframe computers versus PCs and commodity servers), substitution (fixed price sales and internet search versus online auctions), product failures (Internet Explorer security holes versus Firefox browsers), and raising prices above customers' willingness to pay (Netscape browsers versus Microsoft browsers) can reintroduce competition in markets which appeared to have tipped.

Multiple Equilibria and Expectations

One of the most important consequences of network effects (both direct and cross-group) is the possibility of multiple equilibrium market outcomes (keeping all else equal). Which equilibrium will arise is crucially determined by ▶ expectations of the market participants involved. For instance, if each individual participant expects one product or technology to win (i.e., to draw the largest number of users), then each participant has a strong incentive to adopt that product or technology only, leading to *self-fulfilling expectations*.

Consequently, markets with network effects *can* exhibit inefficient outcomes; that is, the best technology or product (in the sense of total social value created) may not win. Instead, winners may be determined by historical accident (cf. the QWERTY keyboard example studied by Arthur 1989) or path dependence (i.e., the first technologies to market have an advantage). Furthermore, tipping *may* occur as the result of sudden changes in market participants' expectations (e.g., holding expectations biased in favour of one technology over another) and without any change in the underlying market 'fundamentals'. For example, in a classic battle over network effects in the internet browser business, webmasters were unwilling to commit to Netscape's browser (and build their websites around Netscape's technology), despite an early mover advantage and a dominant market share. Once Microsoft signalled an unswerving commitment to winning in browsers, it successfully froze webmasters until the outcome of the battle was clear (Cusumano and Yoffie 1998).

Indirect Network Effects and Multi-Sided Platforms

The distinction between direct and cross-group (sometimes called 'indirect') network effects was made early on (Farrell and Saloner 1985; Church and Gandal 1992), but the systematic study of firms serving multiple and interdependent customer groups did not develop until the early 2000s. In the following decade, there was an explosion of work on cross-group network effects, 'multi-sided platforms' and the implications for strategic management. Notable early contributions include Schmalensee (2002), Caillaud and Jullien (2003), Evans (2003), Rochet and Tirole (2003, 2006), Parker and Van Alstyne (2005), Armstrong (2006), Evans et al. (2006) and Hagiu (2006).

Much of the literature on multi-sided platforms (MSPs) focused on pricing; that is, the choice by MSPs to subsidize the participation of one or more sides and make most of their profits by charging other sides. An obvious example was eBay's decision to charge sellers, but not buyers. One of the core pricing principles that emerged was that MSPs should charge *lower fees* and derive *lower profits from* the side(s) that generate(s) relatively *stronger cross-group network effects* for the other side(s) (Parker and Van Alstyne 2005; Armstrong 2006; Hagiu 2006; Rochet and Tirole 2006). More recent research has explored non-price, economic and strategic issues, such as how firms should *design* a platform to drive stronger cross-group network effects (e.g., Parker and Van Alstyne 2008; Hagiu and Jullien 2011), and how to set rules for *governing* a platform (e.g., Boudreau and Hagiu 2009).

Subtleties of Network Effects

While the definition of network effects is straightforward, their nature can be quite subtle in practice. First, the difference between network effects and economies of scale is not always clear cut. Consider the example of search engines like Google and Bing. Clearly, they exhibit *cross-group* network effects: the advertisers' willingness to bid for sponsored search keywords has increased with the size of user traffic. But do search engines also exhibit *direct* network effects? Indeed, the quality of the service provided to users (accuracy of search results) *has* improved with the number of users. With several hundred billion searches per year, Google could improve its search algorithms more quickly than competitors. But this was an instance of economies of learning and scale (Varian 2008). Still, users who understand this mechanism may start making their search engine

choice decisions (e.g., Google versus Bing) based on the number of other users they think are using each search engine. In fact, just as with many information goods, the quality of search can be hard to ascertain directly. In this case, economies of learning and scale can be transformed into network effects by the *user decision-making process*. Of course, even when such direct network effects appear in search, end-user switching costs remain quite low, so tipping is not guaranteed.

Second, network effects are not always exogenously given: their existence and magnitude may instead be endogenously determined by firms' strategic choices.

Whether network effects are present or not depends on the relationship between the focal firm and other market participants, particularly in the context of multi-sided platforms (Hagiu and Wright 2011). For example, Microsoft Windows exhibits cross-group network effects because (a) it enables *direct interactions* between users and application developers and (b) both users and developers are affiliated with Windows by making relationship-specific investments in it (users purchase and learn how to use Windows; developers make their apps using Windows application programming interfaces, or APIs). In contrast, Dell's or Lenovo's PC hardware does not exhibit cross-group network effects. Although they are at least as important as Windows in enabling users–developer interactions, application developers do not make any investments specific to Dell's and Lenovo's hardware.

The magnitude of cross-group network effects depends on the contracts implemented by multi-sided platforms, in particular on the extent to which they enable *direct* interactions (Hagiu and Wright 2011). For instance, Amazon functions as an online retailer for some of its products and as a marketplace for others. The online retailer model exhibits weaker cross-group network effects: Amazon buys products from suppliers and resells them to end-users in its own name. These suppliers care about the number of consumers shopping at Amazon only insofar as Amazon does not take full inventory risk for their products. In contrast, in the marketplace model, Amazon enables third-party suppliers to sell directly to consumers, using Amazon's website and shipping capabilities. In this latter model, the value for third-party sellers much more clearly and directly increases in accordance with the number of Amazon customers – and vice versa. Another example is online dating. Match.com allows anyone to join its two-sided platform, while eHarmony screens its participants carefully. Both exhibit cross-group network effects between men and women, but, at *equal numbers*, eHarmony arguably generates stronger network effects because of the higher 'quality' (i.e., suitability for long-term relationship) of its members (Halaburda and Piskorski 2010).

Network effects have been a cyclical academic industry: interest in the phenomena peaked in the late 1990s, with the dot-com boom. Early in the next decade, network effects were often discounted until a new literature emerged on MSPs and cross-group network effects. Looking forward, it is the potential to drive network effects endogenously through strategy that should place them at the core of the strategic management literature.

See Also

- ▶ Economies of Scale
- ▶ Expectations
- ▶ Software Industry
- ▶ Winner-Take-All Markets

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Neuroeconomics

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Abstract

The neuroscientific revolution in psychology and economics is reformulating long-held views of cognition and emotion and their effects on behaviour. In so doing, it is causing strategic management researchers to rethink a number of the core assumptions underpinning the behavioural microfoundations of the entire field.

Definition Neuroeconomics is the application of neuroscientific methods and concepts to the analysis of problems of economic exchange. Using insights pertaining to neurological and cognitive functioning, gained via brain imaging and related psychophysiological techniques, neuroeconomics seeks to peer inside the 'black box' of economic behaviour.

Building on new methods and concepts pioneered in neuroscience, neuroeconomics emerged in the late 1990s and deepened the connection between the once disparate fields of psychology and economics, a connection forged earlier by behavioural economists. Recent findings have questioned many of the basic psychological assumptions embedded in standard economic models, attempting to render theories about the nature of economic exchange more consistent with contemporary understanding of the workings of the human brain (for an overview, see Loewenstein et al. 2008). Strategic management scholars have watched these developments with keen interest, stemming from an enduring concern with the integration of economics and psychology that can be traced ultimately to the Carnegie School's foundational ideas of bounded rationality, satisficing and organizational slack (Simon 1947; March and Simon 1958; Cyert and March 1963). Analogous to the manner in which

information processing models from early experimental cognitive psychology influenced the Carnegie School and related research in strategic management (cf. Stubbart 1989), the emerging field of neuroeconomics promises to play a valuable role in inspiring strategy scholars to theorize systematically about how forces such as emotion and self-regulation influence strategic thought and action.

A fundamental assumption supported in neuroeconomics is that thinking, feeling and behaviour result from the interplay of multiple physiological, neural and cognitive systems. Bernheim and Rangel (2004), for example, differentiate a 'cold' cognitive mode of brain functioning from a 'hot' emotional mode of brain functioning, while Camerer et al. (2005) outline a two-dimensional model that distinguishes automatic versus controlled processes from cognitive versus affective ones. The use of functional magnetic resonance imaging (fMRI) techniques, in conjunction with simulated decision tasks under experimental control, is enabling researchers to identify the precise brain regions associated with particular types of decision process, linking them, in turn, to specific economic behaviours. A common finding in such studies is that emotional processes seem to play a major part in tasks hitherto considered the preserve of more reasoned, rational, cognitive processes.

In one influential study, Sanfey and colleagues (2003) used the ultimatum game, a simulation that requires players to decide whether to accept or reject proposed splits of a sum of money. They found that participants who rejected unfair proposals showed increased activity in the anterior insula, a region of the insula cortex associated with negative emotion, suggesting that a hard-wired emotional reaction that resists unfairness influenced their decisions. Controversy surrounds this type of research, both in relation to the methods employed and the inferences drawn from findings. For instance, some researchers maintain that fMRI techniques, used to detect patterns of blood flow to particular brain regions as a proxy for the assessment of electrochemical activity, are too crude a basis for identifying the neural substrates of particular cognitive-affective decision processes. In terms of inference, it does not necessarily follow that the brain regions activated while performing a given task 'cause' the phenomena under investigation.

Neuroeconomics is preoccupied with emotion–cognition interactions because these interactions challenge a fundamental tenet of neoclassical microeconomics: rational choice. By way of illustration, the 'risk as feelings' model of Loewenstein and colleagues (2001) shows that many decision behaviours are determined not by cognitively calculating the consequences of choice (i.e., the rational view), but, rather, by emotional and visceral reactions felt in response to the options presented. Furthermore, when visceral feelings and deliberative thoughts diverge, often the former prevail over the latter (Bechara et al. 2000). The more general promise of this line of enquiry is that by better understanding the emotional side of judgement and ▶ decision-making under risk and uncertainty, researchers will be better equipped to understand a range of economic phenomena, from boom and bust cycles in stock markets to gambling.

Given the foregoing advances, perhaps it is no surprise that scholars have recently begun to consider the implications of neuroeconomics for the field of strategic management. However, opinions vary regarding how deeply strategy researchers should delve into neuroscience. Powell (2011) recently offered a balanced view, arguing that, although such endeavours might validate some of the key psychological constructs underpinning the strategy field (e.g., loss aversion) and help inform practice (e.g., by improving executive judgement through informed training), they also raise concerns regarding reductionism and the potential for researchers to be seduced by problems not central to strategic management. Nevertheless, a number of researchers have already begun to travel down the empirical route, using fMRI to study entrepreneurship (Lawrence et al. 2008), leadership (Waldman et al. 2011) and strategic decision-making (Laureiro-Martínez et al. 2010).

Hodgkinson and Healey (2011) take a different view. They argue for a first principles approach

that draws on state-of-the-art social neuroscience insights to variously challenge and/or extend extant theory and research in strategic management, and, indeed, the management and organization sciences, more widely, without, at this juncture, having to embark on primary data collection with neuroscience techniques (see also Hodgkinson and Healey 2008; Hodgkinson et al. 2009). They contend that the overriding message of neuroeconomics (and social neuroscience more generally) – that emotion and less deliberative cognitive and affective processes are not mere hindrances but also vital to skilled human functioning (see Hodgkinson et al. 2008) – requires a fundamental rethink of the 'cold cognition' concepts and theories that make up the behavioural (micro-)foundations of strategic management, many of which remain rooted in the cognitive psychology of the mid-twentieth century.

By way of illustration, Hodgkinson and Healey (2011) demonstrate how the ▶ dynamic capabilities of sensing, seizing and transforming that enable firms to adapt and change each depend on individual and collective cognitive and emotional capacities working in tandem (cf. Teece 2007). More specifically, sensing opportunities and threats in the environment (sensing) involves handling affective information to guide attention and using emotion to keep mental models up to date. In strategic decision-making, positive and negative emotion play major parts in respectively reducing commitment to failing activities and building commitment to new strategic options (seizing). Similarly, reconfiguring the identity of the firm and its agents (transforming) involves skilful emotion management. These arguments complement other work pertaining to the dynamic capabilities project (Augier and Sarasvathy 2004; Augier and Teece 2008) that seeks to use fundamental insights about human cognition to reconceive strategy as a process of evolution with design (see also Hodgkinson and Starkey 2011, 2012).

The jury is still out on the extent to which strategic management ultimately needs neuroscience. But, much in the way it has forced a major rethink in psychology and economics, neuroeconomics is already acting as a valuable catalyst for reconsidering some of the basic premises of the strategy field.

See Also

- ▶ Behavioural Strategy
- ▶ Cognition and Strategy
- ▶ Decision-Making
- ▶ Dynamic Capabilities
- ▶ Heuristics and Biases and Strategic Decision-Making
- ▶ Neurostrategy

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Neurostrategy

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Abstract

In recent years, strategy researchers have sought to combine behavioural theories with traditional economic views of the firm. As the behavioural trend continues, insights from behavioural neuroscience will play an increasing role in strategic management. Powell (2011) coined the term 'neurostrategy' to describe research at the intersection of strategic management and behavioural neuroscience. He argued that properly designed research projects in neurostrategy can help researchers to validate strategy constructs, measure variables, test theories and generate new research ideas. He also noted that neurostrategy brings new challenges – for example, interdisciplinary collaborations can be time-consuming and costly, and brain processes are not always the appropriate unit of analysis in strategic management. On balance, neurostrategy can contribute to strategic management if strategy researchers work closely with neuroscientists on targeted research problems for which brain imaging, neuropharmacology and other neuroscientific methods can provide behavioural insights.

Definition Neurostrategy employs the methods of social, cognitive and affective neuroscience to advance theory and practice in strategic management.

Introduction

At the end of the last century, behavioural movements in economics, finance, law and marketing brought an increase in interactions between social scientists and experimentalists in psychology and neuroscience. From these interactions emerged new sub-disciplines such as ▶ neuroeconomics, neurolaw, and neuromarketing. In the early twenty-first century, the behavioural trend gained momentum in strategic management – for example, in ▶ behavioural strategy (Powell et al. 2011), the behavioural theory of the firm (Gavetti et al. 2012), behavioural decision research (Moore and Flynn 2008), strategy as practice (Johnson et al. 2007) and the search for micro-foundations of strategic management (Felin et al. 2012). Hence, the question inevitably arose: does strategic management need neuroscience?

Experience in neuroeconomics has shown that neuroscience can enliven economic debates and offer new ways of looking at old problems

(Glimcher et al. 2009). At the same time, neuroscience brings problems of its own, such as false inference, extreme reductionism and different research questions from those in economics or strategy. For neurostrategy to contribute to strategic management, researchers need to acquaint themselves with the state-of-the-art in cognitive neuroscience, identify distinctive research questions suited to the methods of neuroscience, and work closely with neuroscientists to develop theory and design empirical tests.

Notwithstanding the potential obstacles, brain research has much to offer, and its influence on the social sciences will grow. As Powell (2011: 1484) wrote: 'If executive decision making and behavior matter, then the brain is already in the game; and the more we can learn about it, the better.'

Strategy and Neuroscience?

The origins of neurostrategy coincided with similar movements in other management disciplines. In organizational behaviour, Becker et al. (2011) advocated 'organizational neuroscience' for problems such as social learning, implicit attitudes and workplace discrimination. Senior et al. (2011) called for research in 'organizational cognitive neuroscience' in areas such as leadership, social learning and employee selection. Powell and Puccinelli (2012) discussed the potential of brain technologies for emotional regulation in organizations. In leadership studies, the Neuroleadership Institute ran international summits, published a journal and solicited empirical studies on ▶ decision-making, emotional regulation and change management.

Powell (2011) argued that neuroscience offers three potential contributions to strategic management. First, it can assist with construct validation. For example, willingness to pay (WTP) is an important construct in the resource-based view of the firm, but difficult to observe directly; behavioural experiments measure revealed preferences but not WTP as a mental construct. However, studies in neuroeconomics show that WTP correlates with neural activity in a single area of the brain (the ventromedial prefrontal cortex) for a range of diverse commodities (Padoa-Schioppa and Assad 2006, 2008; Plassmann et al. 2007; Chib et al. 2009; Hare et al. 2010). Hence, WTP appears to be a single mental construct.

Neuroscience can also assist with theory testing. Phenomena such as self-serving attribution and escalation of commitment can be studied without cognitive neuroscience. However, behavioural experiments alone often fail to resolve theoretical disputes about cause and effect. For example, escalation of commitment may have many causes (calculation errors, attribution errors, self-presentation), and it is difficult to adjudicate on them from behavioural observations. This is a promising line of research in cognitive neuroscience; for example, Campbell-Meiklejohn and colleagues (2008) linked escalations of commitment to a variety of brain regions associated with expectations of reward, appetites, addiction and uncertainty avoidance, suggesting that escalation is a complex phenomenon with multiple causes.

Third, neurostrategy may have implications for strategy practice. Powell and Puccinelli (2012) argued that neurostrategy may help executives improve emotional self-regulation; for example, reducing decision impulsiveness and increasing openness to alternative points of view. In an EEG study of 50 executives, Waldman et al. (2011) found that electrical activity in the right prefrontal cortex was correlated with independent measures of vision and social communication skills. The authors concluded that 'the brain itself might be used to better develop exemplary leadership potential' (p. 72).

Research Methods

Some common research methods in behavioural neuroscience are described below.

Electroencephalography (EEG) uses electrodes placed on the scalp to measure electrical activity in the brain. EEG does not give a picture of the brain but a record of electrical activity that can be compared with patterns for control subjects. It is also used to detect 'event-related potentials' (ERP), that is, changes in brain signals in response to a stimulus.

Positron emission tomography (PET) detects brain activity by measuring blood flow. Activated regions of the brain require oxygen and glucose, which are carried in the bloodstream. In PET, a radioactive substance is injected into the bloodstream and a large cylindrical scanner is used to track the amount of radiation in different parts of the brain.

Functional magnetic resonance imaging (fMRI) uses magnetic technology. The subject lies on a table inside a large cylindrical magnet, or brain scanner. When blood cells migrate to active parts of the brain, they 'deoxygenate' (give up their oxygen). Deoxygenated blood cells respond differently from oxygenated cells to a magnetic field, and the scanner measures brain activity as the ratio of oxygenated to deoxygenated blood cells – what is called the 'blood oxygenation level dependent effect', or BOLD effect. The resolution of an fMRI scan depends on the power of the scanner, which can vary from less than 1 Tesla (1 T) to 8 Tesla (8 T) (a 3 T scanner is about 50,000 times the earth's magnetic field).

Computed tomography scanning (CT or CAT-scan) uses X-rays to detect the density of different parts of the brain, forming a picture of its gross structure that distinguishes bone from white or grey matter. The subject lies on a table that moves into a large cylinder where X-rays are taken.

Transcranial magnetic stimulation (TMS) uses a magnetic pulse to stimulate or inhibit a particular area of the brain non-invasively. Passing a TMC coil over a distinct area of the skull helps researchers infer the role of the underlying brain regions.

Neuropharmacology uses manipulations of neurotransmitters such as serotonin and dopamine to understand the chemical foundations of cognition and behaviour.

Research Questions in Neurostrategy

Neuroscience methods can be used to examine many theoretical and empirical problems in strategy. Neuroscientists generally accept the evolutionary view that the brain has evolved in response to environmental demands for survival, reproduction and fitness. However, this form of evolutionism places few constraints on subject-specific theorizing in behavioural strategy or the range of potential research questions in neurostrategy.

Researchers in neurostrategy are well advised to let the research question determine the method rather than the other way around. Brain imaging has received a lot of attention in the popular press, and people find brain pictures fascinating (Weisberg et al. 2008, found that brain pictures make explanations more convincing even when the pictures are irrelevant). As in all good research, the problem should drive the selection of methods.

Powell (2011) identified eight potential research questions in neurostrategy. Some of these deal with the mind of the individual strategist – for example, studying the neural correlates of risk and entrepreneurship. A second group deals with traditional problems in competitive and corporate strategy – for example, testing cognitive representations of competitive groups and corporate diversification. A third is concerned with the strategy process – for example, the neural correlates of group decision-making, decision-making with uncertain implementation, and routines and capabilities.

Not all of these questions require new research in neurostrategy. Some of them have received attention from neuroeconomists and experimental psychologists, and strategy researchers should familiarize themselves with the current state of the field. The key to success in neurostrategy is focusing on core research problems in strategic management. For example, the role of emotions in consumer choice is not a problem unique to strategic management, and has been studied extensively by cognitive neuroscientists; but the role of emotions in decision-making in top management teams is a core problem in strategic management, and a suitable topic in neurostrategy. For such problems, behaviourally minded strategy researchers have much to gain from brain research, and their collaborations with psychologists and brain researchers may, in

turn, bring new perspectives to behavioural neuroscience.

See Also

- ▶ Behavioural Strategy
- ▶ Cognition and Strategy
- ▶ Decision-Making
- ▶ Neuroeconomics
- ▶ Psychological Basis of Quality Decision-Making
- ▶ Social Cognition

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New Organizational Forms

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Abstract

Strategy scholars use organizational form to determine similarity between organizations. Organizational form has traditionally been determined according to whether or not an organization possesses a set of features. Recently, some scholars have argued that membership in an organizational form should instead be determined according to whether or not audience members perceive that the organization possesses a set of social codes. Organizations belonging to a new organizational form face specific challenges, because new forms lack clear boundaries, established schemas, and scripts to guide actions and

legitimacy from external stakeholders. Some new organizational forms to recently emerge include hybrid organizations and network forms of organizing.

Definition New organizational forms are new types of organizations which either include one or more common features or traits (e.g., firms belonging to the 'network form' are organized around social networks) or are perceived by external audience members to possess the same social codes (e.g., audiences perceive a firm to belong to the form 'quantum computing').

Organizational form is the unit of analysis most frequently used by researchers in strategy in order to determine variability within a set of organizations. For example, an analysis of the strategies and performance of biotechnology firms necessitates that scholars can identify the group of organizations that belong to the biotechnology form. In the literature there are two approaches to defining organizational form. The first is the trait-based approach, which defines that an organization belongs to an organizational form if it possesses specific features (Carroll and Hannan 2004). The classic example of the trait-based approach is Max Weber's (1978) specification of the rational-legal ▶ bureaucracy. Weber identifies the central traits of bureaucracies as the nature of authority, procedures and employment relations. Scholars using the trait-based definition of organizational form have tended to specify an organizational form as characteristics of an organization that may be found across industries, like the multi-divisional (M) form (Davis et al. 1994), the ▶ matrix organization (Ford and Randolph 1992) or network forms of organizing (Powell 1990).

A second and more recent definition of an organizational form is that an organization can be said to belong to an organizational form if it adheres to specific social codes (Polos et al. 2002). This is known as the boundary-based approach (Carroll and Hannan 2004). According to this definition firms are considered as belonging to a particular form not if they possess the same traits as other organizations, but if their external audiences perceive them to satisfy the same social codes. Scholars following this definition of an organizational form have used the notion of organizational form to distinguish between industries by asserting that most industries have their own organizational form. For example, a firm belongs to the population of semi-conductor firms if audience members recognize it as such.

Specific strategic challenges arise for firms participating in new organizational forms. New organizational forms are often characterized by ambiguous boundaries (Santos and Eisenhardt 2009) and a lack of agreement on the schemas and scripts that might guide strategic actions (Kaplan and Tripsas 2008). Such disagreements and confusion can be both an opportunity and a liability for firms' strategic actions. On the one hand, firms participating in a new organizational form face the liability of newness of the form itself. However, the confusion around the form might also be an opportunity, as firms strategically claim membership in multiple forms by hedging their affiliation (Granqvist et al. 2013). Furthermore, early participation in an industry means that firms might stake out advantageous positions, thus gaining a timing advantage (Lieberman and Montgomery 1988; Suarez and Lanzolla 2008).

New organizational forms lack legitimacy. This lack of legitimacy poses strategic issues for firms as they try to convince stakeholders, such as funding agencies and customers, about the viability of their venture (David et al. 2013). Firms can mitigate the challenge posed by this lack of legitimacy by referencing competitors early during the emergence of a new organizational form, in order to aid audience members in recognizing these firms as members of the same form. After the form is established in the minds of audience members, firms benefit from distinguishing themselves from the competition (Kennedy 2008; Navis and Glynn 2010).

Examples of new organizational forms that have emerged recently include the network form (Powell 1990) and hybrid organizations (Battilana and Dorado 2010), whereas the multi-divisional form has been decreasing (Davis et al. 1994).

The network form of organizing is 'typified by reciprocal patterns of communication and

exchange' (Powell 1990: 295) between organizations. This typified exchange can be manifest at multiple levels of the organization – individual, projects, divisions or organizational. Yet scholars who have studied the network form of organizing have often primarily relied on strategic ▶ alliances or financial ties among organizations in order to study the effects of networks on organizational outcomes such as growth and innovation (Powell et al. 1996). The network form of organizing poses strategic challenges for firms in choosing the optimal network position (Powell and Grodal 2005).

Hybrid organizations are organizations that blend two different organizational forms (Battilana and Dorado 2010). For example, organizations might blend the for-profit and the non-profit form by displaying traits of both. Such blending of organizational forms results in strategic opportunities and constraints for firms. On the one hand, hybrid firms are able to be multivocal and exploit opportunities by participating in multiple arenas (Powell and Snellman 2004). On the other hand, hybridization poses a liability for firms because they have to manage conflicting audience expectations (Hsu 2006; Hsu et al. 2009).

See Also

- ▶ Alliances
- ▶ Bureaucracy
- ▶ Entrepreneurial Startups (*de novo*), Diversifying Entrants (*de alio*) and Incumbent Firms
- ▶ Matrix Organization
- ▶ M-Form Firms
- ▶ Organization Theory

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New Product Development

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Abstract

New product development is a phased process for bringing new products to market. The process begins with opportunity analysis and strategic planning. Product ideas are generated, screened and developed into concepts. Concepts are refined and evaluated, and selected for development according to business and strategic criteria. During development, technical work is done while marketing staff prepare for the product launch. The principle underlying this process is to keep the amount of financial and human resources at stake low while uncertainty is high, and to reduce uncertainty while increasing resource commitment as the product moves through the process.

Definition New product development is the process which a firm employs to bring new products to market. It begins with opportunity identification and strategic planning. Ideas are generated and expanded into concepts, which are assessed for technical and market feasibility. The best concepts are selected for technical development, testing and refinement. A marketing plan is then prepared and the product is commercialized.

The Product Development and Management Association defines new product development as 'the overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product' (PDMA 2006). The process begins with opportunity analysis and strategic planning, as the firm needs to decide what their new product objectives are and what kinds of ideas they should consider. At that point, ideas for new products are generated and assessed for technical feasibility (i.e., 'could we make this?') and commercial feasibility (i.e., 'would they buy this?'). Weaker ideas, or those that do not fit with the strategic plan, are eliminated and the better ones are developed into more fully formed product concepts. Concepts are tested with customers, poor ones are eliminated and the best ones may be further refined or improved. At this point, a few high-potential concepts remain. Using financial and strategic criteria, the firm screens these and selects the best concept(s) to be promoted to technical development. Here, the technical work is done on the product, prototypes may be built and tested with potential customers, while marketing prepares for the forthcoming launch. A market test may be conducted as a final check of the product's commercial viability. The product is commercialized and its results tracked and compared with strategic objectives. Modifications in the product or its marketing support may be required so that the product reaches its objectives.

The process outlined above is viewed as a sequence of phases, each followed by an evaluative task. The evaluation tasks may be thought of as decision points at which 'Go/No Go' decisions are made. Therefore, out of hundreds of available ideas, only some make it to the concept phase. Some concepts are eliminated at concept testing; others are moved into development. Product use testing or market testing may screen out some projects, while the best projects are further refined and readied for commercialization. The principle behind this phased process is that, at the earliest phases, there may be a wealth of ideas – with not a great deal invested into any one idea at this time – but there is also a lot of uncertainty about technical and commercial viability. At each later phase in the process, the amount of financial and human resource commitment increases greatly. The phased process reduces the amount of uncertainty as the commitment of financial and human resources increases. By the end of the process, though marketplace success may not be guaranteed, the firm has reduced the possibility of failure. In fact, the 2003 Comparative Performance Assessment Study (CPAS), a research study on new product success, suggests that the typical success rate is overall about 60%, higher in some industries and lower in others (Boike and Adams 2004; Barczak et al. 2009).

More Details on the New Product Development Process

Ideas can come from a range of sources: from customers, marketing or engineering staff suppliers, distributors, laboratories, senior management and others. Creativity exercises can be used to generate long lists of ideas from these individuals. Poorer ideas can be screened out by senior management, while better ones move to the concept stage. One can think of a product concept as a more fully formed idea, explicit enough that the firm could go to potential customers and get a reasonable early assessment of interest in the concept before committing financial and human resources. The concept test may also suggest improvements to the best concepts. (See discussion of ideas and concepts in Crawford and Di Benedetto 2011: 95–124).

Even with careful concept evaluation, there may still be far too many concepts that seem promising. The final step before beginning the development stage, then, requires that the hurdle rates are quite high. Often, a formal screening model is used here, where each concept under consideration is assessed on several dimensions of technical and commercial feasibility.

Once the product goes into development, the technical team members may be developing blueprints, making and testing prototypes, and achieving performance specifications. Marketing people are busy at this time as well. They will be responsible for identifying the performance levels required by the targeted customers, and working closely with the technical staff so that the product will be satisfactory to customers. Techniques such as House of Quality may be used to facilitate communication between marketing and technical staff (Hauser and Clausing 1989). Alpha and beta tests (early use tests with employees and with customers, respectively) may be conducted at this point. Marketing also prepares for the launch at this stage, by making decisions such as brand name selection and package design, as well as developing marketing budgets and timetables.

Just before launch, a market test may be undertaken. Years ago, this might have been a full test market, in which the product is sold in selected test cities under real conditions for several months. This is an expensive and time-consuming process, however. While this is still done in some high-risk situations, many firms will try a simulated test market under controlled circumstances to gain an early assessment of likely trial and repeat rates within a matter of weeks, and at much lower expense than a full market test.

Realities in the New Product Development Process

While the new product development process is often depicted as linear phases as described above, it is probably more accurate to say that firms allow some overlapping of phases in order to accelerate time to market – that is, marketing does not wait for R&D to throw the finished product over the wall before it begins developing marketing plans and strategies. The process can be accelerated by having a multifunctional team devoted to new product development from the earliest phases. Functional areas or departments such as marketing, engineering, production, manufacturing, R&D and so on are usually represented on this team. Of course, good team leadership and effective communication among team members are essential to increasing team efficiency.

Another reality is that adhering to a strict Go–No Go decision at each evaluation point may be overly restrictive and may also waste development time. The CPAS study (Boike and Adams 2004) finds that about 50% of firms make conditional 'Go' decisions occasionally – that is, the product is given a conditional pass to the next phase. Evaluation tasks with conditional outcomes are sometimes called 'fuzzy gates'. Nevertheless, the fuzzy gate still must have 'teeth': a firm Go–No Go decision must be made as soon as the required information is available. A related problem is 'hollow gates': a product passes an evaluation point but no financial commitment is made to it. Eventually, the firm will have committed to too many product projects (Cooper 2008).

In addition, most product managers use the new product development process in a flexible manner. A totally new-to-the-world product entails far more uncertainty, and requires far more financial and human resources, than an incremental new product. At Procter & Gamble, for example, developing and commercializing Dryel or Febreze (both new-to-the-world consumer products at the time of launch) carries much more uncertainty than launching a line addition to Tide detergent. Therefore, the full new product development procedure is more likely to be carried out in risky developments, while phases can be overlapped or simplified for less risky ones. The CPAS study (Boike and Adams 2004) found that in 40% of radical projects, phases were overlapped or skipped; this increases to 59% for incremental projects.

Other Strategic Elements in New Product Development

The first phase of the new product development process, even before idea generation, is strategic planning. Without a new product strategy, sometimes called a product definition or ▶ product innovation charter (Crawford and Di Benedetto 2011), a firm's new product efforts would be unfocused, and time and resources would be wasted on products that are not consistent with the firm's core competences or overall business strategy. In one classic study, firms that developed a strong product definition achieved an 85% success rate and a 37% market share; these numbers declined to 26% and 23% respectively if product definition was weak or non-existent (Cooper 2001).

In addition to a strong new product strategy, management should also consider the fit of a potential new product into its current portfolio. While just about every firm will consider financial criteria such as expected profits or net present values in project selection, top firms consider strategic dimensions as well, such as whether the product would help the firm reach long-term objectives, or whether it is potentially a platform for product development in the future (Blau et al. 2004). There are many other strategic dimensions that can be considered here: balancing high-risk versus low-risk projects, extending the current product line versus expanding into new product categories, strengthening sales in the domestic market versus exploiting foreign markets, and so on. As an illustration, a firm may want to have a balance between enhancements of existing products, next-generation versions of existing products and breakthrough products. If portfolio analysis suggests that any one of these product groups is under-represented, then new product development efforts should be aimed at rectifying the imbalance. In a major report on product portfolios, it was found that careless implementation of a product portfolio results in too many incremental projects (viewed as easier and less risky, at least in the short run) and inefficient allocation of financial and human resources (Cooper et al. 1997, 2002).

The Use of New Product Development Processes

Recent research shows that about 70% of firms use a phased new product development system as described here, and that in almost 50% of firms, each phase in the process is followed by a clearly specified evaluation task. As evidence of the importance assigned to this task, about 40% of firms employ a process manager directly responsible for the management of this process (Griffin 1997; Cooper et al. 2002; Adams 2004; Kahn et al. 2006). Further, firms that use a phased process have better teamwork, higher new product success rates, shorter product cycle times and better new product launches (Cooper 1996). The importance of new product development to the bottom line is clear: in the CPAS study, leading firms in their respective industries tended to obtain almost 50% of sales and profits from new products, compared with only about 21% obtained by their lower-performing rivals (Boike and Adams 2004).

Good overviews of this process are presented in Cooper (2001) and Crawford and Di Benedetto (2011).

See Also

- Closed Vs Open Innovation
- Demand for Innovation
- Innovation
- Innovation Strategies
- Open Innovation
- Product Innovation
- Research and Development (R&D) Organization
- Research and Development (R&D) Investment

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New Security Economics

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Abstract

New security economics is a new and emerging field. It relates to defence economics in much the same way that the field of strategic management relates to the field of economics; it builds upon some similar foundations, but it is more interdisciplinary and more dynamic in scope and content. This article presents a brief introduction to the framework of new security economics, its relationship to strategy and some current themes and topics in the field.

Definition New security economics is a new and emerging field. It relates to defence economics in much the same way that the field of strategic management relates to the field of economics; it builds upon some similar foundations, but it is more interdisciplinary and more dynamic in scope and content.

The relationship between economics, the changing dynamics of the economies, globalization, strategy and security have recently become prominent. Scholars, strategists and practitioners have all pointed to the various aspects of the interrelations, arising both from the security and strategic implications of the changes in the economies and the globalization of businesses and the economics of strategy and defence (which also has changed, from a neoclassical focus to a more dynamic and evolutionary). Thus, new security economics

is a framework that embraces the intersections between the changing dynamics of the strategic landscape (in both business and in the security arena), the changes in the economics of strategy, and developments in economics (towards a more interdisciplinary, behavioural and evolutionary perspective). Like the field of strategic management in its early years, new security economics aims to provide an empirically relevant understanding of certain phenomena within the real of strategy.

The Changing Economics of Defence and Strategy: A Brief History

With regard to the strategic landscape, a major changes has been the movement from a bipolar Cold War towards a multi-polar world with many more players, shifting alliances and the increasing importance of competencies and capabilities that are flexible, adaptive and dynamic. Within the business context, we see this manifested in notions such as hyper competition, ▶ globalization, various theories of internationalization and ▶ foreign direct investment (FDI). And within the security context, the competition is no longer understood as one between a few big players. Issues of conflict and terrorism have also become essential to conflict (Shubik 1998, 2007), as have matters of the evolutionary nature of man (Rosen 2005).

With regard to the economics of defence, the 'old' defence economics was founded by the pioneering contributions of Charlie Hitch and R. McKean, applying (neoclassical) economic ideas to the national security area (including issues of the efficient allocation of resources for defence, personnel and procurement). Defence economics during the Cold War also included contributions to economic models of alliances, the economics of arms races and the influence of military spending on economic developments. Steps towards professionalization of the field were also taken with the establishment of journals such as *Defence Economics*.

Developments within economics since Hitch and McKean include evolutionary economics, behavioural organization theory, and concepts such as limited rationality, satisficing and competencies, that became important foundation stones within the emerging field of strategic management. A more behavioural and dynamic/evolutionary perspective on the economics of defence views the strategic competition not as one among maximizing individual players, but rather one among different types of organization and organizational structures, each with people with limited rationalities, histories, cultures and so on. Building strategy upon those foundations becomes thus about creating and utilizing asymmetries in strategic situations, seeing strategy as something evolving (and not tied into a 'plan'), and involving constant adaptation to a changing global landscape (see March 2005; Augier and McNab 2011).

Interestingly, the roots of both 'old' and 'new' defence economics go back to the ▶ rand corporation. Proponents of both neoclassical defence economics and systems analysis (such as Hitch and McKean and Alan Enthoven), as well as those favouring more organizational, evolutionary and behavioural approaches (such as Sid Winter, Andrew Marshall, Richard Nelson and James Schlesinger) worked at the RAND Corporation during the 1950s and 1960s and contributed extending economic perspectives on defence and strategy to become more empirically realistic and less oriented to models and measurements – an indication of the institution's 'golden years', which also included its contributions to many other pioneering developments in economics, business and management education (Augier and March 2011).

There are still substantial links between economics, the economy and defence and strategy concerns, including in areas such as defence spending and defence budgets; the application of cost-effectiveness techniques to defence expenditures; the economics of defence companies and industries; relations between strategic alliances, aid and economic development; the economics of military organizations and personnel; the economics of R&D; the economics of centralization and decentralization; and the economics and funding of terrorism.

But new security economics – in keeping with the same overall dynamic perspective of much of strategic management today – views these issues in a dynamic and evolutionary perspective, one that takes into account not just spending and numbers per se, but also the *processes* that underlie outcomes and numbers, and what the numbers do *not* tell us, and the differences that different cultural perspectives might mean (in terms of measuring national powers for instance). Furthermore, new security economics realizes the need for a more interdisciplinary perspective, building not only on traditional economic ideas (in pricing, public finance, trade, and so on) but also from organization theory, strategic management theory and the evolutionary and cultural perspectives on human nature known from other disciplines including psychology and anthropology. A good example of the need for a broader perspective is the topic of defence industrial base. We cannot understand the importance of the defence industrial base for US competencies and capabilities without a dynamic perspective, and one that also takes into account the influence of cultures and organizational factors that influence the relative powers among nations.

New Security Economics: Common Emerging Themes

Since new security economics, like the larger field of strategic management, is evolving and encompasses a range of perspectives and traditions, there is not a fixed intellectual structure. Also like strategic management and net assessment, it embraces multiple methods and perspectives ranging from case studies to statistics; and like organization studies it has several 'intellectual roots' but no clear simple tree. The following themes are thus not the only ones that will be important to the field of new security economics, but they do capture much of the essence.

Competition is seen as dynamic process. When trying to understand the strategic landscape in both business and in national security/defence, it makes sense to see it as an evolutionary and dynamic process with forces of adaptation, selection and imitation being operative (as well as a range of organizational and other forces). Technology is important, but so are the intellectual frameworks that drive and influence (and are influenced by) technological change. This consideration embraces the perspective of Nelson and Winter (1982), which also underlies much of modern strategic management, as well as ideas and insights from the competency perspective and Dosi and others' work on technological change. Various examples of competition – from alliances to joint ventures to vertical integration to economic warfare and industrial espionage – must be understood as temporary results of dynamic processes, not as static outcomes.

The players in the competition can be understood as organizations and limited rational individuals shaped by their cultures and histories. When trying to understand the behaviour of decision-makers in defence it is important to recognize that they do not act in a fully 'rational' manner, nor are they unitary decision-makers, acting in an institutional vacuum. Instead, individuals and organizations, whether in business or in defence (and individuals in organizations, such as leaders of foreign countries) have biases and imperfections, and are shaped by their organizational, historical and cultural background and influences as well as those inherent in their evolutionary nature (what evolutionary anthropologist call 'bio grammar').

Strategic phenomena and conflict are the result of complex interactions between a variety of issues. Economics matters but it is not the only element. And it may not always matter in the most straightforward ways: if viewed only through an economic lens, a country that is locked into others by economic ties may be seen as unlikely to enter a conflict. However, when understanding the strategic competition in a more interdisciplinary way, other factors come to light, such as the possibility of entering into conflict to increase internal coherency (but creating an external enemy), and so on.

Strategy is essentially about creating, recognizing, exploiting (intentionally or by chance) and

utilizing one's capabilities to create adaptive capabilities that enable organizational adaptation and survival. While a view of strategy as evolving may seem very different from many narrow strategic planning perspectives, it is consistent with some views of strategy from the behavioural tradition (March 2006), perhaps especially those building on Sun Tzu and the Chinese philosophy of embracing change and transformation and making strategy part of such embrace.

Concluding Thoughts

New security economics is an evolving framework that shares many of the underlying assumptions and intellectual roots of the field of strategic management. It often builds on economics and discusses the strategic implications of economic topics (Augier and McNab 2011), but it does so by broadening the assumptions of economics to include limited rationalities, by taking into account organizational, cultural and institutional factors, and by trying to develop an empirically relevant understanding of strategic phenomena (in Simon's 1997 sense).

As an intellectual framework it is still developing. It embraces a plurality of methods, using insights from different disciplines to develop an understanding of matters relating both to the security/strategic implications of changes in the economies of the global world and to the changes in the economics of strategic concerns.

See Also

- ▶ Globalization
- ▶ Rand Corporation

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Niche Brand

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Abstract

Niche brands target small segments of consumers whose needs differ from those of the general market in the product class (category). Compared with large brands in the market, niche brands tend to have small market share and enjoy higher levels of loyalty and lower levels of penetration than would be expected for their market share. Small firms are prone to adopt niche branding strategies; however, they can also be used by the giants. Scant analytical research has been conducted to help firms identify niche opportunities. Empowering and negotiating with brand communities has been found to be pivotal for building niche brands. Precautions are recommended when growing a niche brand beyond its original market.

Definition A niche brand is one that has a higher level of loyalty and lower level of penetration than would be expected for its market share. Buyers of niche brands seek a distinctive mix of benefits that are either greater or less than the average needs fulfilled by the large brands in the market.

Niche and Niche Brands

'Niche' has been a popular term in the strategy literature (Day et al. 1979; Kahn et al. 1988; Kotler 1991; Fader and Schmittlein 1993), referring to small segments of consumers whose needs differ from those of the general market in the product class (category). As one of three types of ▶ competitive advantages (cost, product/service differentiation and niche), niche branding or niche strategy is an important concept in the strategic planning literature. Through serving only a limited geographic market or focusing product lines on specific types of products, firms get to know a niche segment intimately, leading to either cost leadership or differentiation within the highly focused market.

A small firm or a small division of a large company is often recommended to follow 'niching' as a branding strategy when a product category evolves from introduction through growth to the maturity stage of its lifecycle. Niche brands tend to have a small market share; however, not all small brands are qualified as niche brands. Kahn et al. (1988) provided an empirical approach to classify small-share brands into either niche or change-of-pace based on their level of penetration (the number of customers in the product market buying the brand at least once during a given period) and the average number of purchases per buyer of the brand. When a brand's penetration is low but the purchase frequency is high relative to an average brand for the product class, the brand is labelled a niche brand. By contrast, when a brand's level of penetration and purchase frequency are both low, it is classified as a change-of-pace brand. This empirical definition of niche versus change-of-pace brand represents a deviation from the Double Jeopardy Law (McPhee 1963), according to which brands with a higher market penetration are usually also purchased more often (Ehrenberg 1972).

Niche Branding Strategy

Niche branding can be profitable even with a relatively small market size, for three reasons: (1) a niche market's size and profit potential is unlikely to attract many other competitors; (2) a niche brand may gain certain economics through specialization; and (3) its customers are willing to pay a premium to the firm that best satisfies their distinct set of needs. For instance, Tom's of Maine was acquired by Colgate-Palmolive thanks to its niche position among consumers for its all-natural personal care products and charitable donation programmes. The brand has a 30% premium as a result (Harkavy 2006).

Due to their often limited resources and flexibility, small firms are prone to adopting niche branding strategies. Since the 1980s, mass-marketing companies have lost lots of pieces of their market to niche marketers, confrontations known as 'guerrillas against gorillas' (Dalgic and Leeuw 1994). The low entrance cost of internet marketing has enabled many small start-ups to adopt a niche branding strategy successfully. For example, as compared to MySpace and Facebook, the market-dominating social networking sites that try to be all things to all people, upstart niche players have focused on narrowly defined user groups. For instance, 1Up.com is a content-heavy social site where online gaming fanatics can trade tips and opinions, and Gather.com serves people in the prime of their careers who have disposable income to burn (Klaassen 2006).

As Kotler (1991) observed, companies usually start with niche markets at the initial stage of their product lifecycles. Beauty products retailer The Body Shop, for example, started as a local niche brand founded on a clear understanding of customers' unfulfilled needs, then leapt to be one of the world's fastest-growing and most successful retailers (Dibb and Simkin 1991). Niche branding can also be a viable strategic choice for large companies. For example, healthcare company Johnson and Johnson consists of 170 business units, most of which pursue a niche market (Dalgic and Leeuw 1994).

It is often assumed that niche marketers identify niches by dividing a segment into sub-segments (e.g., Kotler and Keller 2009). Chalasani and Shani (1992), however, believe that niche marketing is a bottom-up approach,

with marketers starting from the needs of a few customers and gradually building up a larger customer base, while ▶ segmentation is the process of breaking a large market into smaller pieces and thus is a top-down approach. No matter how a niche is 'discovered', a company selects a niche branding strategy under the following conditions, according to Leeflang (1990): (1) the company has the ability to approach a niche in a specific manner that is better and different than others; and (2) the company is able to create a considerable amount of goodwill in a relatively short period in order to deter potential competitors.

Suggesting that the key to niche branding is specialization, Kotler (1991) provides the following specialization areas:

- End-user specialization
- Vertical-level specialization
- Customer-size specialization
- Geographic specialization
- Product or product-line specialization
- Product-feature specialization
- Job-shop specialization
- Quality/price specialization
- Service specialization
- Channel specialization.

As Jarvis and Goodman (2005) stated, too often practitioners and academics preach of the pursuit of the 'holy grail' niche position but offer little insight as to how to manage a niche brand. In one exceptional attempt, Jarvis and Goodman (2005) use an analytical approach to locate a position that the market structure and consumer behaviour leaves open as a niche opportunity. More specifically, the authors demonstrate that sufficient polarization (cf. Rungie and Laurent 2005) exists at the top and bottom of the price scale in the Australian wine market, thus opening market space for niche brands. The polarization lends a measure of loyalty that is not confounded by the market share, thus capturing the true loyalty for each alternative brand, whether it is a small-share or large-share alternative. The authors believe that the polarization technique can be extended to other attributes of niche branding (taste, place of origin and varietals, etc.).

Empowering and negotiating with brand communities has been found to be pivotal for building niche brands. Following Schouten and McAlexander's (1995) pioneering article, the idea that consumers group into communities around niche brands such as Ducati and Harley-Davidson has brought the consumer community construct to the spotlight of the marketing field (e.g., Muniz and O'Guinn 2001; Arnould et al. 2002; McAlexander et al. 2002; Solomon 2003; Wipperfurth 2005). Researchers recommend that brand managers create a brand community or try to leverage the existence of tribes of individuals impassioned by a brand (Cova and Cova 2002; Solomon 2003).

It is not hard to find examples of brands that have crossed over after servicing a niche market and become accepted by larger markets for economies of scale and/or commercial viability (Grier et al. 2006). However, whether mainstream audiences are willing to consume niche products after management implements a crossover strategy depends upon whether consumers are diversity-seeking and if the niche brand in question is perceived to be embedded in a niche community (Grier et al. 2006). Therefore, precautions are recommended when growing a niche brand beyond its original market.

See Also

- ▶ Business Strategy
- ▶ Business-to-Consumer (b2c) Marketing
- ▶ Competitive Advantage
- ▶ Market Segmentation

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NK Models

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Abstract

NK models have become increasingly popular in many disciplines, and are used to model systems with several interacting and interdependent parts. Management scholars have modelled innovation, firms and industries, where the parts of the model are technical components, strategic issues or firms in an industry; the interactions between the parts are modularity of components, coupling between issues and competition between firms. This article provides a simplified explanation of fitness landscapes drawn from searches of the physics and biology literatures, and describes management research that applies to NK models.

Definition NK models enable the study of complex systems by abstracting the phenomenon to N parts, K of which interact. They rely on the idea of a fitness landscape and an entity or entities (such as an individual or a firm or firms) which search that landscape. Landscapes with greater interactions between the parts are more rugged and make searches more difficult, especially for local search algorithms. Entities can attempt various strategies; the power of the NK model lies in its ability to observe the efficacy of these strategies.

Many disciplines have begun to model complex systems, where the number of components 'N' and their interactions 'K' become too numerous for analytical solution. In response, first physicists, then biologists, and now management theorists, have developed mainly simulation models that enable them to understand system-level and emergent phenomena.

Physicists built spin-glass models to determine the minimal energy of a system of connected

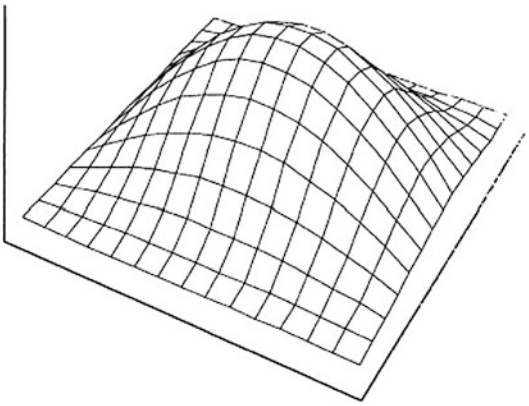
molecular spins (Fischer and Hertz 1993). Kauffman, an evolutionary biologist, introduced it to population genetics (1993). While physicists modelled energy, Kauffman and colleagues (Kauffman and Levin 1987; Kauffman 1993; Kauffman et al. 1994) modified it to analyse the evolution of organisms, basically, to understand how they mutated towards higher fitness. Kauffman examined how the interactions and interdependencies among the fitness contributions of the attributes of the organism impacted its fitness landscapes. These interdependences were labeled *epistatic effects* (Smith 1989); their analogue in the management literature was first discussed by Chandler (1962), when he considered the challenging interdependencies between a firm's strategy and organizational structure. Simon's research (1969), with its focus on components and their interactions, also predates and resonates with NK modelling.

Before proceeding, we will give a brief introduction to the ideas behind NK modelling (technically interested readers should consult the citations below; less interested readers can skip to the applications of the NK model, also below).

The Fitness Landscape

The NK model is built upon two ideas: the fitness landscape, modelled with two parameters N and K, and the entities searching and acting across that landscape.

Sewell Wright (1931, 1932) first introduced the concept of a fitness landscape. Kauffman (1993) defined a fitness landscape as a fixed multidimensional space in two dimensions (see Fig. 1). Essentially, entities search across the landscape for higher positions on that landscape. Within a fitness landscape, the NK model is used to identify the local optima, their fitness level and the possible adaptive walks aimed to improve the fitness level (McKelvey 1999). The number of attributes of the organism or entity (N), and the interdependencies among these attributes (K), determine the smoothness of the landscape. In a strategic context, the N attributes could be the number of decisions the firm or entity has to take;

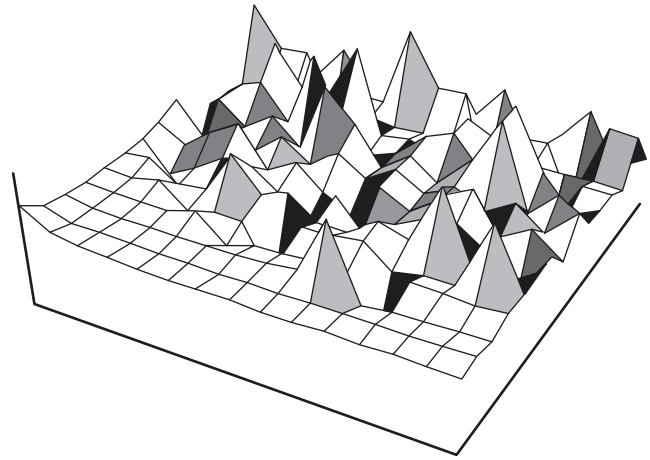


NK Models, Fig. 1 Smooth fitness landscape (From Gavetti and Levinthal 2000: 119–120)

K could represent the degree of interaction and interdependence among them. The higher/lower the interactions among the attributes/decisions, and therefore the value of K, the more rugged/smooth is the fitness landscape. Figures 1 and 2 represent examples of smooth and rugged landscapes. On the one hand, in a smooth landscape there is only one local optimum and the adjacent points in the landscape have similar fitness values (Fig. 1). On the other hand, an increase in epistatic (interaction and correlation) effects increases the ruggedness of the landscape and the number of local peaks (Fig. 2). The single maximum in Fig. 1 can be attained with a simple hill-climbing algorithm, even if the search must be entirely local (imagine finding the peak in Fig. 1, even if it is foggy – all one has to do is go uphill all the time). By contrast, Fig. 2 has many maxima, and simple hill-climbing algorithms will typically strand the searcher on a local maxima, and fail to find the global maxima, particularly if the searcher cannot view the entire landscape.

The Model

In Levinthal (1997) terminology, an entity or an organization is composed of N attributes $\{x_1, x_2, \ldots, x_N\}$ (such as organization structure, decisions, strategy, internal system, processes structure etc.) which can have just two possible values. The fitness environment, therefore, consists of 2^N



NK Models, Fig. 2 Rugged fitness landscape (From Gavetti and Levinthal 2000: 119–120)

possible types of entities, or decision choices in a firm context, and the overall behaviour of the firm is determined by the vector of attributes $\boldsymbol{x} = \{x_1, x_2, \ldots, x_N\}$. Moreover, the fitness of each entity depends on the interactions among K attributes; thus, K is a variable summarizing the degree of epistatic interactions. A given attribute x_i interacts with K adjacent attributes: therefore, each attribute has 2K + 1 different values according to the values of the attribute itself and of the adjacent attributes. In order to identify the K adjacent elements, the x vector is considered circular. A different formulation of the model does not consider the interaction involving the K successive elements as proposed by Levinthal (1997) but rather other randomly chosen K elements of the string. However, such a formulation does not significantly change the results (Kauffman 1989).

Each attribute x_i makes a contribution C_i to firms' fitness value. At the two extremes, if K equals zero, the contribution of each attribute x_i to the entity's fitness is independent of all other attributes ($C_i = C_i(x_i)$). Whereas if K takes on the maximum value of $N - 1$, the contribution of any attribute is influenced by the value of all the other attributes ($C_i = C_i(\boldsymbol{x})$). Then, for each configuration of the vector (x_i, x_{i1}, x_{i2}, …, x_{iK}), a value of contribution is derived from a uniform U[0,1]. A random number is assigned for each possible 2K + 1 combination of the value of the attribute itself (either 1 or 0) and the value of the K successive attributes (each of which also has a value of 1 or 0). This assignment is given for each of the N attributes and the total fitness for an organization is the average for the N attributes. Generalizing the formulation (as proposed in Rivkin 2000: 828) provides a formulation for the overall value of each configuration, as the average over all the N contributions:

$$P(s) = \left[\sum_{i=1}^{N} C_i(x_i; x_{i1}, x_{i2}, \ldots, x_{iK})\right]/N$$

This framework specifies the intensity of interaction effects via the parameter K but provides no restrictions on the particular functional form of the interaction effect (Gavetti 2000). Moreover, NK specifications do not imply a specific structure on the interactions among the attributes (Lenox et al. 2006).

Various dynamic specifications of the NK model have been developed in the literature by allowing distortions and shocks in the NK environment (Chang and Harrington 2000; Gavetti 2005; Lenox et al. 2006, 2007; Ganco and Hoetker 2009). In particular, an important specification of the model is the NKC model developed by Kauffman (1995) in which the coupling among the sub-landscapes of each entity is taken into account. In this case the shape of an NK

space remains exogenous to the entity's search process; Ganco and Hoetker (2009) relax this assumption.

Applications of NK Models to the Management Literature

Most applications of NK models remain theoretical, though empirical research is increasing (Levinthal 1997; Fleming and Sorenson 2004; Lenox et al. 2006) developed one of the first NK models to test organizational adaptation and population-selection processes. He analysed how and why adaptation leads to few emergent forms and how selection impacts the frequency distributions of these forms. The impact of the two processes is determined by the degree of epistatic interactions: the more the interactions, the greater the typical difficulty and decreased effectiveness of organizational change. Levinthal used this framework to model both local and long-jump search efforts, efforts which attempt to increase an organization's fitness. Local search means that organizations look for a better form in their immediate neighbourhood (March and Simon 1958; March 1991; Simon 1991; Levinthal 1997). Longer jumps imply search beyond the immediate neighbourhood (Kauffman and Levin 1987; Ganco and Hoetker 2009). In these cases the firm experiments with a location far from its current location; the process is much riskier, since further locations are less correlated with the current location. However, if a firm is stuck on a local optima, it must take these chances in order to adapt.

NK models have been applied to many subfields in business and management, including the cognitive and experiential literature (Gavetti and Levinthal 2000), innovation studies (Levinthal 1997; McKelvey 1999; Ghemawat and Levinthal 2000; Rivkin 2000; Fleming and Sorenson 2004), knowledge diffusion (Sorenson et al. 2006) and industrial dynamics (Lenox et al. 2006). Gavetti and Levinthal (2000) used NK models to study forward-looking and backward-looking processes and to examine how cognition impacts these experiential learning processes. As underlined by Levinthal (1997: 936), firms' activities are interdependent when 'the value of a particular activity depends on a variety of other activities'. Complexity in firms has been studied in strategic management by focusing on the degrees of interactions among strategic decisions (Simon 1962; McKelvey 1999; Rivkin 2000) and the interdependent competencies which have to be combined in innovation processes (Zander and Kogut 1995; Fleming and Sorenson 2004).

The NK model has also been applied in the management literature to study organizational diversity as a result of epistatic effects (Levinthal 1997) and industry dynamics in the presence of interdependency (Lenox et al. 2006). Indeed, diversities among forms, organisms or entities are influenced not only by history and by the environment in which entities of forms are active, but by the alternatives among which a fitness improvement is available (Hawley 1968; Levinthal 1997). Lenox et al. (2006) applied NK models to industry dynamics to identify how interdependencies influence industry evolution.

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Nonaka, Ikujiro (Born 1935)

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Abstract

Ikujiro Nonaka is a leading thinker in the field of organizational knowledge creation and management. His ideas are informed by careful study of product development at leading Japanese, American and European companies, military organizations and political structures, and by his study of liberal arts. His most important contribution, the SECI model of knowledge creation process, describes how successful firms create new knowledge and value through the ongoing conversion of the tacit knowledge of employees into explicit, shared knowledge that forms products and services, and generates new tacit knowledge through their use. To advance this model, top management provides direction and vision, frontline employees grasp knowledge from the actual situations, and middle managers synthesize that of top management and frontline employees to produce the desired outcome.

Ikujiro Nonaka is a leading thinker in the field of organizational knowledge creation and management. His ideas, developed through careful study of product development at leading Japanese, American and European companies, and military organizations and political structures, has helped

to stimulate academics and practitioners in the West to pursue a less linear approach to ▶ innovation. His work has also helped to stimulate efforts to document and manage both tacit and explicit organizational knowledge in corporate databases.

Background and Early Career

Nonaka was born in Tokyo in 1935. His childhood was marked by the Second World War and a national defeat that he attributed to superior American technology (Helgesen 2008). He earned a political science degree at Waseda University in 1958, then accepted a position at Fuji Electric, a manufacturer of industrial machinery.

As personnel manager at a Fuji factory, he created one of the country's first skills development programmes for line managers by adapting a system in use at a nearby US air base (Helgesen 2008). The system was rolled out more widely at Fuji Electric and then developed into a programme for use at other companies, in cooperation with Keio University.

His work with the university exposed him to ideas from US business schools, which led to a desire to attend one. In 1967, after working in a variety of departments at Fuji Electric, he went to the United States to attend the University of California at Berkeley, where he earned an MBA and then a Ph.D. in business administration, studying consumer marketing and sociology (Helgesen 2008).

His study of philosophy continues to impact on his business theories, particularly the difference between two approaches to knowledge. One, which he saw as dominating Western thought, views knowledge as coming from a search for universal principles. This can be traced back to the ancient Greek philosopher Plato. An alternative to this is the notion that can be seen in Eastern thinking, whereby knowledge comes from particular experience.

After receiving his Berkeley Ph.D. in 1972, he returned to Japan, teaching at Nanzan University from 1977, National Defense University from 1979, and then, from 1982, Hitotsubashi University, Graduate School of International Corporate Strategy. Since 2006, he has been a Professor Emeritus at Hitotsubashi.

Throughout his career, he collaborated with Hirotaka Takeuchi, also a Ph.D. in Business Administration from UC Berkeley. Nonaka was also the Fuji Xerox visiting professor at the University of California, Berkeley's Haas School of Business from 1997 to 2001. He has a lifetime Visiting Scholar status at UC Berkeley, an unusual recognition. During several visits to Haas beginning in the 1980s, he collaborated intensively and productively with ▶ David J. Teece on issues relating to innovation and knowledge management.

Research and Theory Development

In the early 1980s, an important strand of Nonaka's research involved the detailed analysis of product development projects at companies in Japan, including Canon and Honda. Although the prevailing theory was that business decisions should be made in a logical manner following a set algorithm, his observations of product development revealed the presence of important decisions based on intuition that did not always appear ex ante logical.

Nonaka's research led to many well-cited articles including the 1986 Harvard Business Review article 'The new new product development game' (Takeuchi and Nonaka 1986). The article argued that global competition required product development to become faster and more flexible. To do so, it needed to abandon a sequential approach in which a concept was fully elaborated and then handed off to sequential stages of development. Later, the 'scrum approach' of product development presented in this entry was adapted by software development in the 1990s. 'Agile scrum' development has now become the standard approach worldwide. (The mention of a scrum is in reference to the game of rugby where a scrum restarts the game.)

Nonaka extended his interest from information processing to a more general theory of organizational knowledge creation that was presented in

embryonic form in a 1991 Harvard Business Review article titled 'The knowledge-creating company'. Although his focus appears to be on innovation, he defines it broadly: 'To create new knowledge means quite literally to re-create the company and everyone in it in a nonstop process of personal and organizational self-renewal everyone is a knowledge worker' (Nonaka 1991: 97).

As this suggests, Nonaka's work puts great emphasis on an organization's creation and management of its human capital resources, to which he felt that Western management theories had been paying too little attention. According to Nonaka, 'The scientific method and the case study method seek to discern objective principles rather than describing subjective experience, so they overlook the value of relationship and the evolving nature of human capabilities' (cited in Helgesen 2008: 7).

Nonaka's theory on knowledge creation process was presented in the form of SECI (socialization, externalization, combination, and internalization) in a 1994 *Organization Science* article and then, a year later, in a book-length exposition (with Hirotaka Takeuchi) which re-used the 1991 title, *The Knowledge-Creating Company* (Nonaka and Takeuchi 1995). The model is described in the next section.

Although Nonaka's writing is often philosophical in nature and based on subjective observations, many aspects of his model have been empirically verified. In particular, the management of teams and the benefits of healthy conflict have now been well documented (e.g., Dooley and Fryxell 1999; see Nemeth 2012, for an overview).

Nonaka's research is a 'relentless pursuit', as his own theory suggests. Following the SECI model, he has presented other concepts and frameworks: dynamic model of knowledge creating organization, wise leadership, knowledge-based business model, dynamic fractal organization, to name a few (Krogh et al. 2000; Nonaka and Teece 2001; Nonaka et al. 2008, 2013; Nonaka and Takeuchi 2011). Theory of knowledge-based management is, in itself, a process of innovating new management theory and practice.

SECI

Nonaka's SECI model is a two-by-two matrix with modes of knowledge conversion between tacit and explicit knowledge. 'Socialization', for example, involves the propagation of tacit knowledge from one individual to others through shared experience, such as on-the-job training. It is also the mode by which much of a corporate culture is conveyed (Nonaka 1994: 19).

Knowledge creation occurs in every mode of SECI model; individual tacit knowledge is converted to explicit, collectively constructed concepts ('Externalization'); being synthesized with newly explicit knowledge from others ('Combination'); then giving rise to new tacit knowledge as part of a learning process ('Internalization'), and so on as the SECI process repeats in the spiral.

The conversion from tacit to explicit is different from the narrow process of codification as conventionally understood – that is, the simple documentation of personal knowledge – because it may involve not so much as writing or recording as it does communicating via metaphor (Nonaka 1994: 20). The distinction is between information (facts) and knowledge (understanding).

Another important aspect of the model is that knowledge, as it is converted, is also 'amplified', passing from the individual to the group, and then to the organization (Nonaka 1994). Knowledge should be accessible across and beyond the enterprise, forming 'knowledge ecosystems' (Nonaka et al. 2000). Leaders must arrange an appropriate environment, called 'Ba' (Nonaka and Konno 1998), for sharing knowledge between individuals, within teams, and across and beyond corporate boundaries to create new knowledge.

The more that information about the knowledge of employees is widely available (for example, by mapping the locations within and beyond the organization where distinctive knowledge assets reside), the more likely that an employee will find a new combination that can address a challenge. Strategic flexibility to exploit new opportunities is also ensured by such information 'redundancy' (Nonaka 1994: 29). This is where database-driven approaches to knowledge

management fit into Nonaka's SECI model framework.

Although knowledge creation needs to be an ongoing function of all employees of the organization, the process is not entirely open-ended. Project-based knowledge creation must be goal-oriented, with the goals shaped by project leaders. The teams should be given autonomy to achieve their goals within the limitations of time-to-market and other requirements (Nonaka 1988).

The Role of Middle Managers

Managers at different levels of the organization play key roles in the process of knowledge creation. Top management leads the process and judges its outcome. Middle managers are responsible for promoting the process.

Top management is responsible for providing a vision for what it wants the company to become and for the products and services it wants to produce. This vision of the future must go beyond goals defined by financial metrics and inspire the passion of employees. Top management also determines the organization's particular balance between its control over employees and their creative autonomy; it also sets and supports project teams and task forces.

Middle managers in Nonaka's model take on the vital role of bridging the visionary ideals of top management and the chaotic realities of front-line workers. This model, which Nonaka (1988) calls 'middle up-down management', puts middle managers in the most entrepreneurial role. Once top management has fulfilled its role to challenge and inspire, it is up to middle managers to lead cross-functional teams in the give-and-take of knowledge creation tasks, such as product development.

A team breaks into sub-units that concurrently tackle different elements (or, sometimes, alternative approaches to a single element) of the task (Takeuchi and Nonaka 1986). The project managers leading the team must foster an atmosphere, or 'ba' that encourages open information sharing and debate.

Nonaka contrasts middle-up-down management with a more traditional top-down approach. In the top-down model, top management specifies new product concepts. The organization then executes, with workers responsible for fully documenting their work to maintain maximum fungibility of human capital. This leads to organizational rigidity and a failure to exploit the knowledge-creating potential of employees.

Because Nonaka's middle-up-down management approach emphasizes flexibility, he considers it to be particularly vital at times of crisis. While search must be enabled in many directions in order to consider as many options as possible, it is up to managers to direct this chaos toward purposeful knowledge creation' (Nonaka 1991: 103). The ability to handle crises creatively rather than destructively must be built into the company's structure and routine (Nonaka 1994: 28). The ability to channel crises into new opportunities is a key ▶ dynamic capabilities of an enterprise (Teece et al. 1990, 1997).

The middle-up-down management model is inward looking (Lee and Teece 2013). Due to the increasingly global distribution of the sources of knowledge, managers must scan widely for new technological and business opportunities and threats. Middle-up-down management is complementary to other genres that emphasize the importance of external networks to the generation and communication of new knowledge.

The Wise Leader

Nonaka and Takeuchi recently proposed the concept of 'phronesis' or practical wisdom, which originates with Aristotle, but was derived from the research and study of corporate leaders, political leaders, and war time leaders. They define this as a virtue of exercising judgement and taking action that serve the common good.

In their *Harvard Business Review* May 2011 article, 'The wise leader', they listed six abilities of the wise leader; (1) the ability to judge goodness, (2) the ability to grasp the essence, (3) the ability to create 'ba', (4) the ability to articulate the essence of a situation, (5) the ability to exercise political power, and (6) the ability to foster phronesis in others. With the combination of these

abilities, wise leaders promote the fast spinning of the SECI spiral and relentlessly pursue the common good.

In this *Harvard Business Review* article, ten business leaders appear as exemplars, nine are Japanese and one is Indian. Some may think there is no more to learn from Japanese management, especially after the lost decades; however, the concept of the wise leader who aims at the common good of society may be the one to watch.

See Also

- ▶ Dynamic Capabilities
- ▶ Firm Resources
- ▶ Innovation
- ▶ Knowledge Management Theories
- ▶ Leadership
- ▶ Organizational Learning
- ▶ Teece, David J. (Born 1948)

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Non-market Strategy

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Abstract

We organize ostensibly disparate approaches to the study of non-market strategy by extending constructs and classifications first proposed by Barney (Academy of Management Review 11:791–800, 1986) in the context of 'market' strategy. The organizing framework revolves around the conception of competition associated with a given theoretical

approach. Applying this framework to non-market strategy research illuminates several areas requiring further investigation, which mainstream strategy scholars are well positioned to conduct.

Definition The field of non-market strategy examines how business organizations respond to, and influence, their broader political and social environment.

Introduction

The field of 'non-market strategy', which examines how business organizations respond to, and influence, their broader political and social environment, is experiencing an identity crisis due to the diversity of research approaches employed in relative isolation from each other. We synthesize these ostensibly disparate approaches by extending constructs and classifications first proposed by Barney (1986) to classify 'market' strategy research. Our dual objectives are to promote the field's coalescence and to provide a ready entry point into the non-market domain for scholars already versed in market strategy research.

Structural Perspectives

'Structural' perspectives attribute performance differences among firms to external structures that govern market or non-market interactions. In the context of market strategy, the leading exemplar of such an approach is the 'industry analysis' perspective, which embraces the industrial organization (IO) conception of competition and ascribes economic performance differences to the extent of industry-level 'barriers' that shield incumbent firms from the profit-eroding forces of market competition (Mason 1939; Bain 1956, 1968; Caves and Porter 1977).

The positive political economy (PPE) approach, which examines how formal political structures influence policymaking outcomes, is most directly analogous to the industry analysis perspective. PPE research employs game-theoretic techniques to model the policymaking process as a game between elected officials and constituent groups that, in the paradigmatic case, exchange favourable public policies for electoral support. Formal structures such as voting rules and committee jurisdictions affect the range of feasible policy outcomes by empowering some officials and constraining others (McNollGast 1987; Shepsle and Weingast 1987; Weingast and Marshall 1988; Gilligan et al. 1989; Tsebelis 1995, 1999, 2002). Early PPE studies yielded the core strategic insight that firms should target their lobbying and influence efforts at 'pivotal' political officials (Baron 1999; Holburn and Vanden Bergh 2002; Baron and Diermeier 2007), while subsequent research focused explicitly on constituents' strategic behaviour – for example, making campaign contributions and selectively providing information to legislators – and expanded the field's purview to include regulatory (Holburn and Vanden Bergh 2004) and judicial (de Figueiredo 2009) behaviour as well as integration with market strategy considerations (Baron 1995, 1997a, b, 2011).

Research in the corporate political activity (CPA) tradition, which focuses on 'corporate attempts to shape government policy in ways favorable to the firm' (Hillman et al. 2004: 838), takes a less formal approach to similar topics. Bonardi et al. (2005), for example, used a supply and demand framework to classify key elements of market and non-market structure that influence democratic policy outcomes. Hillman et al. (2004) summarized such factors at multiple levels.

Theoretical research in the PPE and CPA traditions offers important insights. The intricacies of many PPE models, however, make it difficult to empirically test their predictions, while CPA research, though less formal in its approach, offers too few empirically falsifiable insights to have generated a substantial body of econometric research (see Holburn and Vanden Bergh (2006) for an exception).

International research at the intersection of market and non-market strategy has attempted to overcome such challenges. Henisz (2000a) made

an early contribution in this area, constructing a time-varying measure of policymaking structures influencing the feasibility of policy change in over 200 countries. Multiple studies have found the measure, 'POLCON', to be a statistically and economically significant determinant of such aggregate outcomes as national economic growth (Henisz 2000a) and telecommunications infrastructure investment (Henisz and Zelner 2001), as well as firm-level outcomes such as location choice (Wei 2000; Henisz and Delios 2001; Wei and Hall 2001; Siegel et al. 2011), entry mode (Henisz and Williamson 1999; Oxley 1999; Henisz 2000b), and investment sequencing (Delios and Henisz 2002a, b). Other papers have incorporated the role of interest group influences (Henisz and Zelner 2006) and broadened the field to include the exploitation of political opportunities as well as the mitigation of political risk (Henisz 2012).

A third structural perspective considers informal institutions related to national culture that inform social actors' normative assessment of economic and political practices (Biggart and Guillen 1999). Studies in this vein have focused on how culturally influenced norms of corruption (Mauro 1995) as well as ethnic and religious fractionalization (e.g., Posner 2004; Cederman et al. 2010) influence economic outcomes. Related research has considered the effects of 'cultural distance' between an MNE's home country and a prospective host country, operationalized using measures developed by Hofstede (1984), the GLOBE project (House et al. 2004), and Schwartz (1992; Schwartz and Bilsky 1987). Studies with an international political economy orientation have employed ostensibly more objective measures of 'institutional distance', such as colonial origin (Acemoglu et al. 2001) and religion (Barro and McCleary 2003). The strategies that MNEs develop to assess and manage different forms of institutional distance represent a natural but relatively unexamined topic for non-market strategy research.

Though structural approaches have contributed greatly to non-market strategy scholarship, they have been criticized for leaving little room for agency. Strategic action in PPE models often consists of choosing which political actors to provide resources to without regard to a firm's distinctive resources, capabilities or position, while strategic action in the international political risk tradition is typically limited to assessing the institutional structures governing a given market and deciding whether or how to enter. Neo-institutional sociologists, for their part, have been accused of portraying individuals as 'cultural dopes' (Giddens 1979: 52). Such critiques parallel those made of the industry analysis perspective on market strategy, which has been criticized for downplaying firm-level attributes and providing normative guidance that reduces to the admonition that firms should seek structurally attractive industries or positions.

Resources and Capabilities

In the context of market strategy, the resource-based view of the firm (Wernerfelt 1984; Barney 1991), or 'RBV', arose in response to the perceived limitations of the industry analysis perspective. RBV research employs the Chamberlinian conception of competition, wherein individual firms earn economic rents by deploying distinctive assets that competitors are unable to imitate or substitute for (Chamberlain 1933; Robinson 1933). Non-market approaches differ primarily in the nature of the assets on which they focus.

Studies examining political resources fall into several categories. Early studies linked readily observable firm-level attributes – such as size and profitability (Salamon and Sigfried 1977; Dickie 1984; Masters and Keim 1986) and a physical presence in a nation's capital (Lenway and Rehbein 1991; Schuler 1996), as well as broader environmental conditions (e.g., Schuler 1996) – to an MNE's susceptibility to political risk. More recent research in financial economics has moved beyond the relatively crude measures used in earlier studies to demonstrate that a significant portion of emerging-market firms' value is attributable to political ties (e.g., Fisman 2001; Faccio 2006). Related research has examined the

differential value of political ties under various scenarios (e.g., Virany et al. 1992; Pei 1996; Siegel 2007; Okhmatovskiy 2010). Data gathering efforts such as Bruce Kogut's (2012) 'Small world of corporate networks' initiative may shed additional light on the importance of domestic and international ties as well as these ties' evolution over time.

As noted above, much market strategy research in the resources and capabilities tradition has emphasized the role of knowledge assets, especially those developed through experiential learning. In the non-market domain, Delios and Henisz (2000) performed an early large-n study of this type, demonstrating that the sensitivity of Japanese multinational enterprises' (MNEs) entry-mode choices to host-country political risk declines with relevant international or host-country experience. Subsequently, they found an analogous effect for the prior behaviour of home-country and industry peers on these same firms' plant location choices (Delios and Henisz 2002b; Yiu and Makino 2002; Makino et al. 2004; Chan et al. 2006; Chan and Makino 2007).

Recent studies have focused on the political risk management capabilities that such a process presumably generates. García-Canal and Guillén (2008) and Holburn and Zelner (2010), for example, examined the role of home-country environmental influences on a firm's foreign direct investment (FDI) location choices, finding respectively that MNEs from regulated industries and countries with relatively weak political constraints are more likely to invest in riskier host countries.

Dynamic Approaches

Dynamic approaches focus on the inflection points at which markets, policies, and the institutional structures that govern them periodically transform, altering both the market and non-market environment. In the context of market strategy, such approaches (e.g., Nelson and Winter 1982; Levinthal 1997; Teece et al. 1997) employ a Schumpeterian conception of competition, in which technological revolutions pave the way for entrants to unseat incumbents (Schumpeter 1934, 1947). Analogously, dynamic approaches to non-market strategy seek to identify the sources of major inflection points in the non-market environment and, ultimately, to assist firms in forecasting such shifts. Though such research is in its infancy, a firm foundation already exists in research on agenda-setting, social movements and international policy diffusion.

The agenda-setting perspective in political science (Schattschneider 1967; Downs 1972; Kingdon 1984; Hilgartner and Bosk 1988) illuminates the process by which certain issues make it onto the formal policy-making agenda, as well as the broader pattern of punctuated equilibrium whereby new actors in a given issue domain periodically disrupt sustained periods of policy equilibrium (Baumgartner and Jones 1993). Similarly, social movement theory in sociology focuses on how extra-institutional challenges to authority enter mainstream political discourse (Tarrow 1988, 1996, 2005). The so-called 'World Polity' perspective moves the analysis up a level to examine the normative, mimetic, and coercive influences – manifested in peer country behavior and the demands of powerful global actors – that influence the cross-national diffusion of public policies (Meyer et al. 1977; for a review, see Dobbin et al. 2007).

Non-market strategy research integrating insights from these streams with each other (e.g., Henisz and Zelner 2005; Zelner et al. 2009) and with those rooted in rational-actor models (e.g., Henisz et al. 2005) provides a relatively holistic view of the policymaking process. Such research promises to assist managers in anticipating and managing waves of policy reform.

Conclusion

We hope that mainstream strategy scholars whose work has the most direct non-market counterparts will continue to integrate the two bodies of theory in a manner that lends itself to empirical research. Research efforts should grapple with problems such as:

Non-market Strategy, Table 1

	Market arena				Non-market arena			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Competition concept	IO competition	Chamberlinian competition	Schumpeterian competition	Governance	IO competition	Chamberlinian competition	Schumpeterian competition	Governance
Unit of analysis	Industry	Industry/firm	Industry/economy	Transaction	Industry/economy	Industry/firm	Industry/ economy	Stakeholder relationship network
Core concepts	Structure conduct performance	Monopolistic competition	The engine of creative destruction	Discriminating alignment	Checks and balances interest group competition	Quid pro quo corruption	Coercion legitimacy	Mutual interest and dependence
Disciplinary	Bain (1956)	Chamberlain (1933)	Schumpeter (1934)	Coase (1937)	North (1990)	Black (1948)	Kingdon (1984)	Homans (1958)
Foundations	Bain (1968), Mason (1939), Caves and Porter (1977)	Robinson (1933), Penrose (1959)	Schumpeter (1950), Nelson and Winter (1982)		McNollGast (1987), Bueno de Mesquita et al. (1999), Tsebelis (1995, 1999, 2002), Schwartz (1992, 1994)	Olson (1965), Buchanan and Tullock (1962)	Baumgartner and Jones (1993), Gamson and Meyer (1996), Benford and Snow (2000), Tarrow (1988, 1996, 2005)	Gouldner (1960), Blau (1964), Thibaut and Walker (1975), Lind and Taylor (1988), Scott (2010)
Strategy theorists	Porter (1980)	Barney (1986), Wernerfelt (1984), Prahalad and Hamel (1990), Grant (1996)	Teece et al. (1997)	Williamson (1975, 1985, 1996)	Baron (1999), Henisz (2000), Baron and Diermeir (2007), Henisz and Zelner (2006), Holburn and Vanden-Bergh (2002), Siegel (2007, 2012), Martin and Salomon (2010)	Henisz and Williamson (1999), Henisz and Delios (2001), Fisman (2001), Faccio (2006), Morck (2000), Holbum and Zelner (2010)	Henisz and Zelner (2005)	Henisz et al. (2012)

- How can investors assess the relative costs and benefits of assuming a monopoly position when such a position could engender a socio-political backlash?
- To what extent should a firm sacrifice short-term rents to secure an advantageous long-term position?
- At what point in a wave of policy reform should an incumbent shift its strategic orientation from defending an advantageous position to laying the groundwork for success in a post-reform policy regime?
- How much should a firm invest in political and social capital to promote a stable non-market environment? How should such a firm govern a ▶ stakeholder coalition assembled for the purpose of recouping its initial investment?
- To what extent can concepts and constructs associated with the governance perspective on strategy (Williamson 1999), which emerged after Barney developed his original framework, assist in addressing the last question – with the added complication that governance of political coalitions and advocacy groups hinges less on legal ownership and control rights than it does on informal political and social affiliations associated with identity and perceptions of fairness (Boutilier 2009, 2011; Henisz et al. 2012). Columns 4 and 8 in Table 1 incorporate the governance perspective into the organizing framework laid out above.

Non-market strategy scholars have not yet made sufficient inroads into the market domain that they alone can answer such fundamental questions. Mainstream strategy scholars, we believe, are well positioned to join forces with them.

See Also

- ▶ Corporate Social Responsibility
- ▶ Embeddedness
- ▶ Institutional Environment
- ▶ Reputation
- ▶ Stakeholder

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Norms

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Abstract

Sanctions for conducting activities outside of established norms can be strong pressures for conformity. Such conformity pressures can aid coordination and predictability, but hamper differentiation and have varying effects on innovation. Actors can gain advantageous

positions by influencing norms to benefit their capabilities and by creating norms that reinforce desired behaviours by their shared group members.

Definition Norms are a set of behaviours that become taken for granted as appropriate responses to a given situation. Norms are shared by a referent group and can occur at multiple levels including society, institutions, organizations and groups.

Norms are the backdrop against which many decisions and actions are made, and have a consistent influence on behaviour (Hackman 1976). In organizational discussions, norms are often lumped with the related concepts of rules and routines. While rules are those prescriptions of desired behaviour and routines are the formal and informal daily habits and activities, norms are the values and assumptions that regulate appropriateness of action. Norms constitute a narrowing of expected actions in a social relationship (Weber 1978; Scott and Meyer 1987), and exist when individuals judge what is acceptable through the lens of being in a shared group. Importantly, norms are maintained when they are enforced through punishment of violations. While norms affect behaviour at many levels, the focus here is on how norms affect organizations and groups within organizations.

Formation

Norms develop over time, with social processes providing isomorphic pressures resulting in common practices (Meyer and Rowan 1977; DiMaggio and Powell 1983). Norms evolve from the initial individual calculation of appropriate actions based on rationally based metrics, to assumed patterns of behaviour (Tolbert and Zucker 1983) that go 'beyond the discretion of any individual' (Meyer and Rowan 1977: 344). Once formed, norms exert a powerful invisible social control that is often overlooked by individuals and organizations (Bettenhausen and Murnighan 1985).

Conforming Influence

In a world of dense information, the conforming nature of norms is a linchpin of boundedly rational action as it allows individuals, when faced with interdependence with other actors, to focus on a subset of activities in making decisions (March and Simon 1958). The presence of norms also allows for more efficient coordination and interaction, although sometimes norms inordinately benefit an influential subset of the overall social grouping. Norms can have a strong governing authority on behaviour, even to the point of sustaining unethical behaviour and causing actors to ignore clear cues of deviance (Asch 1956; Milgram 1974). Both externally and internally defined referent groups guide specific repertoires of action (Terry and Hogg 1996).

Actors may find the restrictive nature of a norm undesirable, but because of enforcement pressures they may still acquiesce. Other options when faced with normative pressures are avoidance, manipulation, deviance and compromise (Oliver 1991). For example, one form of avoidance is for organizations to make a show of ceremoniously conforming while continuing to be non-conforming in actual practice (King et al. 2005).

Evolution and Adaptation

At the group level, norms evolve over time through shifts in group demography and survival demands. Group norms are also affected significantly by changes in membership, external cues, status shifts, level of enforcement and critical events (Hackman 1976; Katz and Kahn 1978; Feldman 1984). At the more macro levels, the institutional and societal norms are considered to be more rigid, as multiple inertial forces support the ongoing maintenance of existing norms. Transgression of these strong institutional forces can negatively affect the success of organizational activities such as market entry or alliance formation (Xu and Shenkar 2002).

A more recent perspective on institutional norms suggests that even within strong

institutional forces organizations can adapt and undertake strategic action (Hill 1995; Dacin 1997; Jonsson and Regnér 2009). Organizations that are early adopters may accrue benefits from efficient adaption to normative practices, while later adopters gain legitimacy but limited performance advantage (Westphal et al. 1997). Another way for organizations to gain strategic advantage is to foster self-imposed norms that are aligned with the demands of the environment. For example, an organization that encouraged and maintained internal norms of structural flexibility and learning would respond quicker to technological shifts (Taylor and Helfat 2009).

Impact on Innovation

Norms can have mixed effects on innovative. Strong norms can reduce innovation as deviation from typical solutions are rejected or discounted (Davis and Greve 1997). However, there are several ways that conformity to norms can have a positive outcome on adoption rate. Normative pressures can be contradictory and fragmented (Dacin 1997; Lounsbury et al. 2003), and in those ambiguous situations visible and legitimate actors can create temporary norms of innovative behaviour (Greve and Taylor 2000). Other positive effects are increased adoption rates of compatible innovations in groups with shared norms (Fligstein 1985; Burt 1987), while norms that encourage creativity also increase innovation (Goncalo and Duguid 2012).

Conclusion

Norms are an ubiquitous conforming influence on organizational and group outcomes. Conformity to norms avoids sanctions and improves coordination of action, but can be costly for some actors. Norms are often endogenous, used strategically by organizations and groups to encourage behaviour relevant for the competitive environments.

See Also

- ▶ Behavioural Strategy
- ▶ Bounded Rationality
- ▶ Innovation Diffusion
- ▶ Isomorphism
- ▶ Organizational Routines
- ▶ Risk and Uncertainty

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Not-Invented-Here

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Abstract

'Not-invented-here' (NIH) is the phenomenon whereby ideas originating outside a particular organization or organizational unit are dismissed or downgraded because their source is external to the organization or unit. As markets for the provision of goods and services have become more sophisticated, NIH has developed a negative connotation through its association with insularity and implied detrimental effects on performance. NIH can emerge as an ego-defence mechanism, because of power struggles, or because high performance causes an organization to believe that it internally contains the 'secrets of success'. Awareness of the potential for NIH to emerge can lead senior management to take explicit counteractions.

Definition Not-invented-here (NIH) is the phenomenon whereby ideas originating outside a particular organization or organizational unit are dismissed, or at least downgraded, specifically because the source is external to the organization or unit.

Not-invented-here (NIH) is the term used to refer to the phenomenon whereby ideas originating outside a particular organization or organizational unit are dismissed, or at least downgraded, specifically because the source is external to the organization or unit (Katz and Allen 1982; Lichtenthaler and Ernst 2006).

Although the NIH phenomenon is now treated as potentially applicable in almost any type of organization or function, it originally emerged within the research and development (R&D) community. According to Katz and Allen (1982), 'general folklore' among R&D professionals includes the belief that if the composition of a research group has been relatively stable for a long period, a view may form within the group that it has a particular mastery of an area of knowledge – even a monopoly – such that it is unlikely that any entity external to the group will produce new ideas of value or merit. Katz and Allen (1982) noted that this phenomenon had become known within the R&D community as the 'not-invented-here' syndrome.

Since Katz and Allen's original research on the NIH syndrome in the context of R&D project groups, the concept has been widely applied to a variety of intra- and inter-organizational contexts where the transfer of knowledge is a key issue.

Chesbrough (2003) links the origin of the term 'not-invented-here' to the golden age for internal R&D when extensive vertical integration was characteristic of high-performing companies. In this environment, the utilization of outside providers for key activities that underlay one's competitive position was seen as a form of dependence that increased risk. In this context, NIH signalled that a product/idea had come from outside the organization and therefore had not been subject to the various quality assurances presumed to apply to internally developed components. To a significant extent, this stance had merit, because at that time there were many instances where external markets were not able to provide the needed capabilities as efficiently as were the extensively vertically integrated organizations.

However, as environmental factors have changed – specifically, as external markets for the provision of goods and services have become more sophisticated in terms of key variables such as range, quality and speed – NIH has developed a distinctly negative connotation through the associated implication of insularity and resulting negative effects on performance. That is (Lichtenthaler and Ernst 2006: 376), the implication is that:

> the NIH syndrome may result in the underutilisation of external knowledge, which may lead to inflexibility and may prevent the realisation of opportunities that are based on a combination of internally and externally acquired knowledge.

As the application of the concept of NIH has become applied more broadly than just to R&D situations, it has become part of a range of concepts, including stickiness and ▶ absorptive capacity, which highlight factors that have the potential to impact whether information is transferred and adopted.

Stickiness refers to the fact that knowledge does not necessarily flow freely between source and (potential) recipient. That is, knowledge may be sticky due to the nature of the information itself, the amount of information to be transferred, or the attributes of the provider and/or recipient (Szulanski 1996; Jensen and Szulanski 2004). Absorptive capacity refers to an organizational unit's ability to recognize the value of external knowledge, acquire the knowledge, assimilate the new knowledge within its stock of knowledge, transform existing knowledge in the light of the new knowledge, and exploit the new knowledge in the form of new products or processes (Cohen and Levinthal 1990; Zahra and George 2002; Todorova and Durisin 2007).

However, stickiness and absorptive capacity are not perspectives that are particularly attuned to the behavioural elements of organizational life. As such, they need to be complemented by the micro-foundations of knowledge sharing (Foss and Pedersen 2002). That is, the motivational predisposition of both the source unit and target unit are central determinants of whether effective flows occur (Gupta and Govindarajan 2000). The NIH syndrome is an element of motivational predisposition.

The NIH syndrome can emerge both as an egodefence mechanism and because of power struggles between organizational units (Gupta and Govindarajan 2000). Ego-defense mechanisms can lead managers to resist ideas because they fear that, were they to adopt the ideas, others might question their competence (relative to that of the idea originators). In the context of intra-organizational power struggles, the NIH effect may be most directed at ideas associated with other intra-organizational players, ironically resulting in a bias in favor of ideas identified as originating outside the organization. This bias may be fuelled by the fact that internally originated knowledge is typically more accessible than externally originated knowledge, meaning that the limitations and flaws of the former are likely to be more visible, allowing externally generated knowledge to benefit from less close scrutiny (Menon and Pfeffer 2003).

The NIH syndrome may also occur where organizational units with an established record of high performance and/or reputation become systemically disinclined to be receptive to ideas that do not originate internal to their unit. This outcome occurs where success is interpreted as proof that the unit is doing the right thing, thus making them less receptive to new ideas. This situation can make the organization more vulnerable to changing conditions, a phenomenon that has

been labelled the paradox of success (Audia et al. 2000).

On the other hand, certain conditions can reduce the tendency for NIH to emerge. For example, it is less likely to occur where there is a pre-existing commonality of frame of reference between the source and (potential) recipient units – a 'shared understanding' that 'reflects similarities in heuristics and experiences' (Ko et al. 2005: 75). Another significant contributor to the reduction of the potential for NIH is the 'intimacy' (Szulanski 1996) of the relationship between source and (potential) recipient unit. A relationship that is intimate rather than 'laborious and distant' (Szulanski 1996) reduces the prospects of NIH.

Awareness of the potential for NIH can lead senior management to take explicit action intended to counter such tendencies. Proctor & Gamble's reframing of R&D as 'Connect and Develop' is one in a series of organizational initiatives designed to make a virtue of building businesses by accessing and incorporating ideas that, more often than not, may be found in entities external to the company's comprehensive R&D facilities (Sakkab 2002).

Similarly, in the course of the global expansion of ING Direct, its actions were influenced by a strong belief within its senior management team that the NIH syndrome, should it become manifest, had the capability to severely constrain the innovative capability of organizations or units. Senior management consciously introduced the concept '*Steal with Pride*' into the corporate lexicon to try to give a positive connotation to the discovery and use of ideas and practices that had been invented elsewhere. To reinforce the importance of *Steal with Pride*, annual prizes were awarded to the international subsidiaries that were deemed to have been the most active 'stealer' and 'sharer' of ideas (Dunford et al. 2010).

See Also

- ▶ Absorptive Capacity
- ▶ Capability Development
- ▶ Innovation
- ▶ Open Innovation

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Novelty in Adaptation

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Abstract

Evolutionary theories traditionally neglected the issue of novelty and focused primarily on change and adaptation. Nevertheless, novelty is a central construct and a central phenomenon in organizational theories and life. Studies relevant to novelty can be found in research on 'creativity', 'innovation', 'invention', 'discovery' or 'genius'. Such contributions, however, have pictured a subset of the phenomenon, in that they address the few novelties that result in success. Yet most novelties are failures. Asymmetric sampling is probably responsible for our poor understanding of both success and novelty. In this entry, we reposition the attention to novelty as a neutral phenomenon. We provide a tentative definition using well-known dichotomies: relative/absolute, radical/incremental, Lamarckian/Darwinian, directed/undirected, exogenous/endogenous. We conclude by referring to studies on organizational design for novelty.

Definition Novelty is both the ingredient and the result of adaptation, since it is the material available for natural selection and the response to environmental conditions. Research regarding novelty addresses cases that result in success – such as creativity, innovation, discovery and genius – and usually assumes that recombination is a basic mechanism. Conversely, most novelties are failures and their endogenous generation is still not well specified.

What, If Anything, Is Novelty in Adaptation? A Quest for Attention

In theories of adaptation, novelty is both the implicit 'lifeblood' (Levinthal 2008: 98) and the ancestral 'thorny' problem (Becker et al. 2006: 360). There is no clear, univocal definition of novelty in the social sciences, and not even biology has agreed on a definition. In evolutionary biology, novelty is referred to as variation, combination, mutation, speciation and plasticity. In other fields, intuition more than analysis leads to novelty, being associated with a set of phenomena where novelty is the most readily evident. None of the above is a close synonym; instead, all of them relate to one aspect of novelty. We think of discoveries and inventions in science, of innovation and creativity in management and economics, of genius in entrepreneurship as having different nuances and accents – learning, techno-economic, socio-economic and psychological. All imply success, while most novelties, as we have seen, lead to failure.

Novelty is usually linked to discussions on Lamarckism/Darwinism, gradualism/punctualism, incremental/disruptive, directed/undirected and the exogeneity/endogeneity of evolution. However, these historical polarities have obscured the centrality of novelty and have prevented us from addressing it structurally. Evolutionary theories of biology and of economic change have plunged into the idea of change and adaptation and confined novelty to a set of related but not fundamental issues.

A recent and growing interest in the origins of change and emergence instead of evolution and diffusion, which has appeared both in biology (see the so-called evo-devo stream of research) and in the social sciences (e.g., Padgett and Powell's 2013 book on the emergence of organizational novelty), is moving the concept back to the core of evolutionary theories. In this article, we examine contributions centred on change with a focus on novelty, and we offer a tentative definition.

A Definition Along Dimensions and Levels of Analysis

Novelty is a complex phenomenon; consequently, attempts to define it are inevitably elaborate.

A definition of novelty is correspondingly a definition of 'sameness' (Fontana 2003: 1; Pigliucci 2008: 888), which is the necessary reference point for understanding what is new.

Unfortunately this is no easy task, for at least two reasons.

First, Rosenkopf and McGrath (2011) highlighted that points of reference to assess what is new can be built according to many aspects (e.g., technology, functionalities, and usages of a product). This results in a multidimensional character of novelty.

Second, novelty can be analysed at different levels – within an organization, within an industry, in a set of organizations, or in the system – as well as across them. A definition of novelty requires that novelty is related to the level of analysis adopted. In comparing different levels of analysis, it is useful to distinguish *relative* novelty – what is new among the elements in an organizational system – from *absolute* novelty – what is new to the whole system. Between these two polarities, Fleming et al. (2007) and Frigotto and Riccaboni (2011) have proposed a continuous measure of novelty that is inversely proportional to diffusion.

As in complex phenomena, these measures do not easily converge in signalling novelty or suggesting its relevance. The interaction and the overlap among the dimensions and levels builds a multidimensional space of interactions that has not been completely explicated or clarified and that challenges operationalization techniques and the comparability of research, as well as definition exercises.

Novelty as Incremental or Disruptive, Punctual or a Continuum Phenomenon

A definition of novelty should also take into account the various ways in which novelty appears.

The classical distinction among various forms of novelty has been developed in terms of incremental and disruptive or breakthrough innovation, and it has been debated whether novelty takes place along a gradual continuum (Dosi 1982; Rosenbloom and Cusumano 1987; Basalla 1988) or as a leap in a concentrated timeframe (Abernathy and Utterback 1978; Tushman and Anderson 1986; Anderson and Tushman 1990). Since the work of Schumpeter, this distinction has been recognized as capturing two completely different phenomena (Becker et al. 2006: 356). Hence, novelty occurs in two different ways:

1. As slow improvements as a result of learning, that is, by 'reacting to changes in its environment by following routines that improve slowly with experience'.
2. As 'more dramatic and innovative changes', which Schumpeter called 'developments' that lead from one equilibrium to another 'in such a way that the transition cannot be decomposed into infinitesimal steps (Schumpeter 1934, 1939, 2005)' (Becker et al. 2006: 356).

This dichotomy is a fundamental pillar in the discourse on novelty despite several difficulties in definition and operationalization. An interesting attempt to reconcile this duality is offered by Levinthal (1998) and Adner and Levinthal (2002), who refer both incremental and disruptive changes to one dimension, that is, the 'domain of application' of innovations, and identify more disruptive novelty in distant applications of a known technology, while within domains technological improvements are considered as incremental changes.

Direction and Intention: Teleological Trait of Novelty

Some scholars call for a definition of novelty that refers to the outcome (which is usually thought of as a positive consequence) that the pursuit of novelty helps to achieve. Although this may illustrate the desirable outcome of the novelty pursuit, it both misleads and limits the description of novelty in two ways.

First, while innovation, creativity, discoveries and inventions imply success, they represent only a small subset of novelty. Novelty implies change to something new, and while it includes change that results in success, it largely represents change that is unsuccessful and sometimes even disruptive.

Second, there has been an interesting recent debate about whether change should be intended as Lamarckian or Darwinian (Hodgson and Knudsen 2006, 2010), meaning that novelty emerges for a purpose and conveys a direction, a target, or is the effect of environmental selection on organizational choices, which is typically undirected and does not have a purpose. However, this dualism has not been adequately addressed, and while there are notable exceptions (see Cattani 2006; March 2006; O'Mahony and Bechky 2008), novelty has mainly been studied in terms of deliberate innovation and directed effort. While, in biology, novelty (in the Darwinian perspective) is the material that is available for natural selection to operate in and that results in adaptation, in organizations, novelty is mainly conceived as the result of actions adapted for a purpose (in the Lamarckian view). A real distinction between the two hypotheses is not viable given the lack of analogous means and knowledge of organizations, as molecular genetics is for organisms. In organizations such a toolkit is probably not necessary, as the distinction is in inheritance mechanisms that are less strict in organizations than those in organisms. Consequently, both these components should find room in a definition of novelty and thereby stimulate research on how these two sources of novelty combine, rather than exclude each other, in organizations.

Exogenous and Endogenous Generation of the New

Novelty, especially in terms of technological innovation, has generally been conceived as an exogenous variable in both economics and organization studies. While such a representation is not completely satisfactory to the understanding of novelty, attempts to theorize novelty as endogenous to organizational systems have encountered several challenges that are still far from being resolved.

In theories of organizations, novelty seems reasonably well understood in terms of the incremental modifications of routines that occur as a result of experience (Levitt and March 1988). Contributions have examined how experience constrains search, thus limiting the range and impact of novelty that is found: sight is myopic (Levinthal and March 1993), because local search and short time horizons are preferred. Conversely, few studies aim for a theory of the endogenous generation of novelty (Becker et al. 2006) that also accounts for disruptive ideas despite a tendency to path-dependent search. The questions raised are the seminal ones that the ▶ exploration and exploitation discourse has posed since March's contribution in 1991 (March 1991).

In the managerial literature, recombination has been considered the main source of novelty (Levinthal 2006). The concept of recombination has been associated with several instances that are different in scope and nature, resulting in a confusing if not inconsistent picture.

Research under the label of recombination includes phenomena that in biology are clearly separated. They range from combinations of existing elements, variously identified as routines at the elementary level at which novelty and evolution are deployed in evolutionary theories of both economics and management (Winter 1975: 101; Nelson and Winter 1982: 400; Augier 2005), competencies (Galunic and Rodan 1998), capabilities (Teece et al. 1997), social connections (Padgett and Ansell 1993) and topological spaces (Padgett et al. 2012) that are responsible for producing variation very much like sexual reproduction does in the so-called crossing over of alleles. Nonetheless, they also address more disruptive changes under the label of mutation, where the number or the position of elements changes, or new material is added to the initial set that is available for combination.

Very much like the combination laws in inheritance described by Mendel in biology, reaction laws in chemistry or grammar rules in linguistics, scholars have wished to identify in organizations general combinatorial laws that account for novelty generation and change at the incremental level and similar – even if more erratic – rules for mutation.

From a resource-based perspective, studies on absorptive capacity (Cohen and Levinthal 1990),

architectural knowledge (Henderson and Clark 1990), combinative capabilities (Kogut and Zander 1992) and dynamic capabilities (Teece et al. 1997; Eisenhardt and Martin 2000) have searched, under different labels, for a structure and a dynamics of change and novelty. Contributions vary in identifying combinatorial material at different degrees of specialization and detailed ready-to-use routines, competencies, knowledge, processes, principles, templates, as well as processes of change that are hierarchically and sequentially organized, albeit potentially infinite. Grounded in strategy, these streams of research share an idea of novelty which relies on directed search, intent and will, but that tries to account for the possibility of recognizing (with a stress on cognitive ability, which is also typical of the strategy imprint) unplanned opportunities that appear in the competitive context. This literature has invested considerable effort in specifying concepts and addressing critiques (e.g., Eisenhardt and Martin 2000), and has pointed out the need for a more fine-grained analysis of what dynamic capabilities as processes for novelty generation are, as well as a consideration of the prominent role of undirected search. The work of Cattani (2006) provides an exemplary contribution on both these directories.

However, although some incremental dynamics have been outlined, an understanding of breakthrough novelty generation, or mutation, is still far in the future. Since Schumpeter unsuccessfully searched for patterns and regularities in disruptive change, mutation has been and still is more a 'label for the inexplicable' (Becker et al. 2006: 357) than an explanation of the generation of novelty.

In the behavioural literature, Feldman and Pentland (2003; Feldman 2000) have recently shown that continuous mutation and novelty are an intrinsic characteristic of routines. This perspective is expanding angles and levels of analysis from which novelty can be seen as a micro-level endogenous phenomenon: for instance, Argote and Ren (2012) point to transactive memory systems, and Cohen (2012) identifies the crucial role of habit as a visionary combinatorial power. While this stream is also struggling with the temptation of 'micro-reduction' (Hodgson 2012: 1393) to single elements and laws of change in search for its Mendel, a wider perspective is also regained where novelty is considered a social event whose complexity cannot be captured by a (system of) laws governing the complexity of the interaction within and across levels of analysis.

An alternative perspective conceives novelty as resulting endogenously from the intrinsic fallibility of the reproduction of successful solutions by incomplete copying (Baum and Singh 1994), unreliable imitation of routines, or from inefficient selection processes within organizations (March 2010). The dynamics by which organizations retain less competent managers and dismiss more competent ones because of a rationality of observed consequences (March 1994) provides an example of the latter case.

Engineering Novelty?

Several streams of literature have shown interest in novelty with the purpose of taming it. They have tried to understand how to both direct change and capture undirected change that provides novelty. Maintaining a focus on firms as central actors in the discourse, scholars using the behavioural approach have framed this in terms of local or distant searches.

In order to design organizations that embrace novelty, research has shown the relevance of the following:

- Inefficiencies, that is, 'buffers of action from immediate feedback', such as organizational slack or inattention;
- 'Modes of action that are unresponsive to [or independent from] feedback on consequences' (March 2006: 206) such as intuition, commitments to identities, managerial hubris and optimistic hopes (March and Shapira 1992; March 2010);
- Team composition, diversity (Hong and Page 2004) and interaction or isolation of subgroups (Fang et al. 2010) have been largely investigated in relation to creativity and innovation;

- Roles (Bechky 2006) and structural characteristics, as more than elements of context, so that networks (Powell et al. 1996; Burt 2004) and networks of networks (Padgett and Ansell 1993) seem particularly inducive to the emergence of novelty.

With attention to both behavioural and cognitive aspects, experimental studies have investigated perceived problem formulation and framing in stimulating novelty or supporting transfer (Knez and Camerer 2000). Moreover, scholars have studied the role of narratives as means for learning (March et al. 1991; Bartel and Garud 2009) and directing searches for novelty. Weick (1995) also refers to artefacts, that is, strategic plans or geographical maps that generate sensible narratives.

With a stronger focus on response and reaction than on general attitudes towards novelty, some contributions have addressed bricolage and improvisation (Ciborra 1996) as the processes through which response to novelty is implemented. In this context, novelty is conceived as unexpected events, or surprises (Cunha et al. 2006) deriving more from an active shaping of the environment than from limitations of rationality that impact its analysis. Research at the micro-level of routines can also be seen as addressing questions designed to further the understanding of bricolage and improvisation.

See Also

- ▶ Concept of Strategy and Organizational Evolution
- ▶ Exploration and Exploitation
- ▶ Organizational Learning
- ▶ Recombination of Knowledge

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n-sided Markets

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Abstract

There are many markets with *cross-group network externalities*, called n-sided (or multi-sided) markets. In these markets, platforms operate as intermediaries that enable multiple distinct groups of customers to interact with each other: members of each group benefit from interacting with those from other sides of the market. A fundamental insight of the literature on n-sided markets is that a *pricing structure* that determines price allocation is as important as the overall price levels. I discuss the characterization of the optimal pricing strategy in n-sided markets and its implications for marketing and antitrust policy.

Definition Markets that connect multiple distinct groups of customers are called n-sided (or multi-sided) markets, with n referring to the number of groups that interact with each other. The defining characteristic of n-sided markets is the existence of multiple distinct groups of customers with cross-group network externalities: members of each group benefit from interacting with members from other sides of the market.

Markets that connect two or more distinct groups of customers are called n-sided (or multi-sided) markets, with n referring to the number of groups that interact with each other. Products and services that enable groups of customers to interact in n-sided markets are called platforms.

The defining characteristic of n-sided markets is the existence of at least two distinct groups of customers with *cross-group network externalities*: members of each group benefit from interacting with members from other sides of the market. In such markets, the need to get all sides of the market on board creates a so-called 'chicken and egg' problem (Caillaud and Jullien 2003) for platforms; members of each group are willing to participate in the market only if they expect many members from the other side to participate. Platforms thus adopt various pricing strategies to coordinate participation by different groups, as explained below.

Examples

The best way to explain the concept of n-sided markets is via examples. There are many markets that exhibit n-sidedness, both in the new economy and traditional sectors. The academic literature on n-sided markets typically focuses on the special case of $n = 2$, called two-sided markets for analytical simplicity. The following discussion is thus couched in the context of two-sided markets, but the main intuition and results are easily applied to the case of general n (>2).

A favourite example to illustrate the defining characteristics of multi-sided markets is dating services or nightclubs, where each member of two distinct groups of people (men and women) derives value from interacting with members of the other group. In this example, members of each group obviously derive higher utility as more people from the other group patronize the same dating service or nightclub. This type of *cross-group network externality* is not limited to dating services. Other examples with more significant economic importance include auction sites such as eBay and Yahoo, where buyers and sellers join to complete a deal, credit card payment systems such as Visa and MasterCard, where both merchants and consumers need to participate in the same system, and video game platforms such as PlayStation, Xbox and GameCube, where game developers and consumers constitute the two distinct sides (for more examples see Eisenmann et al. 2006).

Pricing Strategies to Get Multiple Sides 'on Board'

The presence of cross-group network externalities in n-sided markets makes the platform's pricing

and marketing strategies to each side interdependent, because the benefit each group derives from using a platform's services depends on the size of the market on other sides. Thus, platform operators should take into account the impact on the market growth of other sides when they set a price for each side. This interdependency makes platforms' optimal pricing strategies complicated. In particular, the size of the market on each side and the resulting volume of trade between two different sides are determined not only by the overall level but also by the *structure of the prices* charged by the platform, that is, the allocation of the total price among multiple sides. In fact, Rochet and Tirole (2006) take the dependence of the trade volume on the pricing structure *given a total price* (the sum of all prices charged to each side) as the very definition of n-sided markets.

More specifically, cross-group externalities create a coordination problem and raise the issue of multiple equilibria in economic agents' participation decisions. To illustrate this, consider the following simple example of membership externalities. There is one agent on each side in two-sided markets. Each side agent derives a utility of two by participating in the platform if the other side agent also participates, while his utility is zero if the other agent does not. If the membership fee for each side is any number between zero and two, it is easy to see that there are two equilibria: one in which both agents participate and the other in which neither of them does. Thus, one important issue facing platforms in n-sided markets is how to avoid market collapse owing to coordination failure and bring all sides on board by judicious choice of pricing strategies.

Types of Cross-Group Externalities and Pricing Instruments

Suppose that there are two sides of the market, called the buyer side (B) and the seller side (S), with $i \in \{B, S\}$. Let N^i denote the number of participants on side i. To capture cross-group network externalities, the literature typically adopts the following specification for the gross utility an agent on side i receives from interacting with the other side through a platform:

$$U^i = b^i N^j + B^i,$$
$$\text{where} \quad i,j = B,S \quad \text{and} \quad i \neq j$$

The parameter b^i measures the *usage* benefit and B^i represents the *membership* benefit. This specification implicitly assumes that the volume of each agent's transactions is proportional to the number of agents on the other side, with the total number of transactions in the market being proportional to the product of the numbers of participants on each side, that is, $N^B N^S$.

The literature on n-sided markets distinguishes between two types of cross-group network externalities: usage externalities and membership externalities. Rochet and Tirole (2003) developed a pure usage externality model in which B^i is assumed to be zero while b^i is heterogeneous across agents on side i. In contrast, Armstrong (2006) developed a pure membership externality model in which b^i is constant for all agents on side i, but membership benefits B^i differ across agents. The relevance of each model obviously depends on the specifics of industries, such as the nature of cross-group externalities prevailing in the industry. Rochet and Tirole (2006) propose an integrated model that accounts for both types of externalities, and thus encompasses the models of Armstrong (2006) and Rochet and Tirole (2003) as special cases. This integrated model is further extended by Weyl (2010), who introduces a more general form of heterogeneity in participants' preferences than allowed by Rochet and Tirole (2006).

Optimal Pricing Rule in n-sided Markets and Its Implications for Marketing

The general principle that comes out of these models is that the optimal pricing strategy on each side, if the marginal cost of each side is reinterpreted as an 'opportunity cost', follows the standard Lerner formula, that is, a firm's mark-up ratio on each side is inversely related to

the respective price elasticity (Armstrong 2006; Rochet and Tirole 2006; Weyl 2010).

A typical scenario that can arise in n-sided markets is that the optimal pricing structure for platform operators is often characterized by subsidizing certain sides, while the loss from the subsidized sides are recouped by charging high prices in other sides. For instance, consider the video game market where consumers (gamers) and video game developers constitute the two sides, while PlayStation, Xbox and GameCube are major platforms. Video game platform operators' pricing strategy has been to sell consoles at or even below cost. They can lose billions of dollars on new game systems on the consumer side, but the losses are recouped through royalties from game sales.

An important question then for platform operators is which sides should be subsidized and which sides should be the money-making sides. There are two major factors that determine the structure of prices offered to different groups.

1. Relative magnitudes of cross-group ▶ network effects. If participants on a particular side of the market confer large positive cross-group network externalities on other sides, this particular side of the market will be subsidized by platforms to encourage the overall success of the market. Building up a consumer base there enables platform operators to charge more on other sides. For instance, nightclubs often charge a low price or issue a free pass for women while men are charged a high admission fee. Presumably, one way to rationalize this pricing strategy is that men value interaction with women more than the other way around.
2. Single-homing versus multi-homing sides. In some cases, an agent participates in multiple platforms in order to reap maximal network benefits, which is called 'multi-homing' in the literature. When an agent participates in only one platform, he is said to 'single-home'. In the video game market, typical consumers (gamers) buy only one game platform hardware (console), that is, single-home, owing to the high expenses associated with buying multiple consoles. In contrast, video game developers routinely write games for multiple platforms (unless they sign an exclusivity contract with a particular platform). Similarly, in the smartphone case, consumers rarely carry two mobile phones, and the assumption of single-homing would be more appropriate for the consumer side. However, application developers develop their apps for multiple platforms such as iPhone and Android-based phones. Imagine a situation in which one side is single-homing and the other side can potentially multi-home. Then, the multi-homing side (that has flexibility) has to accommodate the platform choice made by the single-homing side. Thus, the single-homing side constitutes 'competitive bottleneck' to the multi-homing side, and platforms can exercise monopoly power against the multi-homing side over access to the single-homing agents. Platforms thus offer low prices to attract single-homing consumers in anticipation of high profits that can be garnered from the multi-homing side. This is another instance that flexibility (the ability to multi-home) can hurt.

Antitrust Policy Implications

The optimal pricing strategies for n-sided markets also suggest that we should exercise caution in applying conventional wisdom from one-sided markets to n-sided markets (Evans 2003; Wright 2004). For instance, we have seen that below-cost pricing for certain sides naturally arises in n-sided markets, even in a monopolistic market without competitors or any threat of entry. Such pricing can be an effort to coordinate users on multiple sides to participate in the market. Thus, below-cost pricing cannot be construed as an automatic indication of predatory behaviour in n-sided markets, and more caution is warranted in applying traditional antitrust logic. The possibility of multi-homing is also an important consideration when analysing anti competitive effects of tying arrangements in n-sided markets. Choi (2010), for instance, shows that tying can be welfare-

enhancing if multi-homing is allowed, even in cases where its welfare impacts are negative in the absence of multi-homing. The analysis can have important implications for recent antitrust cases in industries where multi-homing is prevalent.

See Also

- ▶ Network Effects
- ▶ Platform Innovation

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