Complexity Theory for Strategy Research: Philosophical Arguments

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Abstract

This article presents a review of the philosophical foundations of the dominant theories in strategic management and argues that these foundations lead to significant limitations for the theories' applicability to practice. Complexity theory is presented as an alternative that is better aligned to the phenomena researched by strategy scholars and its philosophical underpinnings and implications are discussed.

Keywords: Philosophical Foundations of Strategic Management, Complexity Theory

1 Introduction

Referring to the state of strategic management research from his vantage point as an observer of large firms, Bettis [1991] begins his editorial essay with the observation that "I am often struck by the sense that most of this research is irrelevant to what is going on in such firms today". While two and a half decades have since passed, the area continues to grapple with the problem of academic research not being able to influence the practice of strategy [Economist, 2007]. The strongly positivistic assumptions originating from the economics roots of the field have been criticized by scholars to constrain the potential contributions that can be made by strategy research.

In the early 21st century, strategy scholars debated on the usefulness of a constructivist methodology as evidenced in the exchanges between Mir and Watson

[2000], Kwan and Tsang [2001], and Mir and Watson [2001]. Durand [2002] and Powell [2002] even debated the contributions of pragmatism in the explanation of competitive advantage. Things really got to a head when Rasche [2008] argued in a book that the field of strategy is built on paradoxical foundations and that strategy researchers have been blind to the philosophical inconsistencies that are present in the dominant theories in the field.

As a student of the philosophy of science, and particularly as one just entering the strategic management research domain, this challenge suggests both an opportunity to contribute to the literature and establish oneself as a scholar on the one hand, and an equally grim prospect as researcher on the other. The problems with the philosophical foundations of the strategic management area have been been analyzed and documented by eminent scholars. But is there an alternate paradigm that can take the area forward? This article is the author's amateur quest at the resolution of a philosophical problem that seems to stands central to his pursuing research in the strategic management area.

The rest of the article is organized as follows. We first present the dominant theories in strategic management and then dissect their philosophical moorings and associated implications. Having argued that the positivist-empiricist philosophical stance has been the bane of strategy research in its effort to remain relevant to practice, we then introduce complexity theory and its basic principles. We then provide a detailed assessment of the philosophical assumptions underlying complexity theory, and argue that with a new view of change, this approach may address many of the problems identified with connecting with the practice of strategy making and implementation.

2 Dominant Strategic Management Theories

Pettigrew [1988] had proposed that research in strategic management may be seen as confirming to within a tripartite framework consisting of a) strategy content - with it's focus on the decision itself, b) strategy process - with it's focus on how the decisions are made, and c) strategy context - with the focus on what circumstances influence strategic decisions. This framework has since been widely accepted by scholars in the area, and has also been the framework used by Rasche [2008] in his critique of the philosophical foundations of the dominant theories in strategic management. Teece et al. [1997] capture the dominant schools in strategic management research and their philosophical orientations in figure 1.

As Teece et al. [1997] capture in figure 1, the strategy area was dominated in

Paradigm	Intellectual roots	Representative authors addressing strategic management questions	Nature of rents	Rationality assumptions of managers	Fundamental units of analysis	Short-run capacity for strategic reorientation	Role of industrial structure	Focal concern
(1) Attenuating competitive forces	Mason, Bain	Porter (1980)	Chamberlinean	Rational	Industries, firms, products	High	Exogenous	Structural conditions and competitor positioning
(2) Strategic conflict	Machiavelli, Schelling, Cournot, Nash, Harsanyi, Shapiro	Ghemawat (1986) Shapiro (1989) Brandenburger and Nalebuff (1995)	Chamberlinean	Hyper-rational	Firms, products	Often infinite	Endogenous	Strategic interactions
(3) Resource-based perspectives	Penrose, Selznick, Christensen, Andrews	Rumelt (1984) Chandler (1966) Wernerfelt (1984) Teece (1980, 1982)	Ricardian	Rational	Resources	Low	Endogenous	Asset fungibility
(4) Dynamic capabilities perspective	Schumpeter, Nelson, Winter, Teece	Dosi, Teece, and Winter (1989) Prahalad and Hamel (1990) Hayes and Wheelwright (1984) Dierickx and Cool (1989) Porter (1990)	Schumpeterian	Rational	Processes, positions, paths	Low	Endogenous	Asset accumulation, replicability and inimitability

Figure 1: Paradigms of Strategy, Adopted from Teece et al. [1997]

the 1980s by the industrial organization driven attenuating competitive forces theory of Porter [1980]. This was then followed by the game theorists whose focus was on strategic interactions. This school of theorizing did not sustain prominence and was superseded by the Resource-based view, that sought to counter the Porterian view by suggesting that firm heterogeneity was a necessary condition for the creation of competitive advantage. While the Porterian view saw the environment as a given, the Resource-based scholars saw firm resources as out there and given. The Dynamic Capabilities school added to the Resource-based school the notion that firms had capabilities and that resources were able to be created through those capabilities. Figure 1 reiterates what strategy scholars have noted in the past - that all the dominant theories in the strategy area are built on a positivist-empiricist philosophical stance where the environment is real, and out there, and where managers are believed to be rational.

3 Issues in the Phenomena under Study

Strategy scholars have dealt with both uncertainty and complexity in the phenomena that they have researched for a long time. However, these are indeed the two dimensions that continue to plague many theoretical models because the conception of either does not lend itself elegant mathematics, or when it does, it does not lead to theory that is reflective of the world of business that strategy researchers study.

3.1 Complexity

Complexity arises in firms and industries by virtue of several interacting parts, including governments, individuals, various stakeholders, and competitors. The typical firm today operates in several countries and by definition is therefore complex. Dominant theories in strategy, and much of the rest of the business school disciplines have tended to make simplifying assumptions, and developed theories assuming a condition of ceterus paribus. This simplification of reality leads to a divergence in the understanding of the context between the researcher and practitioner. Any attempt at bridging this academic-practitioner divide must therefore pay explicit attention to the inherent complexity of the phenomena in strategic management.

3.2 Uncertainty

While practitioners and researchers often refer to uncertainty being an inherent aspect of the world of business, the notion of uncertainty has tended to be somewhat difficult to clearly define. In many ways, uncertainty is seen to go along with increasing complexity. However, the two are not quite the same and it is possible for physical systems to be complex (in that they consist of many interacting parts) but that are not perceived to demonstrate uncertainty. Many dominant theories in strategic management make the assumption that uncertainty is either ignorable or that uncertainty may be statistically quantified and therefore managed. These simplifications are again at odds with the way practitioners perceive uncertainty and must therefore be explicitly addressed in any alternate theoretical formulation.

4 Philosophical Constructions

We noted previously that Teece et al. [1997] had construed the dominant theories in strategic management as being positivist with a firm notion of a real world that was out there independent of managers, and that managers were assumed to behave rationally. Ramoglou and Tsang [2016] use the context of entrepreneurship to delineate the three different philosophical schools of empiricism (that is similar to what we have so far characterized as positivist), constructivism, and realism. Figure 2 provides a summary characterization of the three schools, and how they view the entrepreneurial process. Our notion of the world of business is that while there does exist a real world out there, much of the world is also either made sense of, is socially constructed or is enacted by individuals. Therefore the realist philosophical stance is seen to come closest to mapping accurate the world of business studied by strategy scholars.

Dimension	Empiricism	Constructivism	Realism
Ontology	The world exists objectively "out there," with an emphasis on material existence. Things that exist must be empirically observable. Causation is indicated by the constant conjunction of empirical events.	The idea of an objective world is an illusion; reality is ultimately reducible to social constructions. There is no single way the world is or can be. Agents can willingly create their own realities as long as they regard them as real.	The world exists objectively, albeit in various modes of being. The real is broader than the domain of the empirically observable. Tendencies are unobservable and operate transfactually.
Epistemology	What can count as scientific knowledge must be based on sensory experience, testable by observation and experiment. The objectivity of research outcomes requires the elimination of subjective interpretations.	Contradictory interpretations of external reality can be equally valid. There are no objective criteria for assessing the truthfulness of some categories of knowledge claims, particularly those that relate to social or cultural knowledge.	We can know the world indirectly. Our observations are theory laden and fallible. We may use our imagination in explaining phenomena, but reality imposes constraints on what should be accepted as plausible knowledge.
Conception of entrepreneurial opportunities	*Discovery*: Entrepreneurs discover opportunities that preexist independently of entrepreneurs as empirically undiscovered entities.	*Creation*: Opportunities do not exist until they are created endogenously by entrepreneurs.	*Actualization*: Opportunities are propensities that exist independently of potential entrepreneurs, in the form of unmet or possible market demand that can be actualized into profits.

Figure 2: Comparison of Empiricism, Constructivism, and Realism, Adopted from Ramoglou and Tsang [2016]

5 Limitations of Dominant Strategic Management Theories

Having laid out the principal dominant theories in strategic management, and the primary philosophical schools available to construct our understanding of phenomena, we now attempt to understand the implications of the positivist-empiricist philosophical positions of the dominant theories in strategy.

5.1 Ontological and Epistemological Positions

The nature of strategic management, being inherently associated with questions of day-to-day and practical importance, makes is necessary for both practitioners and researchers to adopt an attitude of determinism in their understanding of the world. Strategy scholars have for long recognized the role of change, and incorporated the pace of technological change, for example in their models. The world of Schumpeterian creative destruction perceived by the practitioner is however one where not only is there change in the environment and in technology, but one where notions of competition and the constructs of value are also changing. With mathematically backed and econometrics models, however, the dominant theories in strategy are unable to model in an adapting ontology or a flexible epistemology. This leads to a divergence in the world modeled by the researcher and the world experienced by the practicing manager.

5.2 Perceptions on Empiricism

The economics inspired foundations of strategic management research leads to the strongly empiricist orientation of much strategy research. So, while the practitioner perceives both hard, out-there aspects influencing strategy decisions, as well as softer, hard-to-measure aspects, the strictly empiricist orientation of strategy researchers forces them to ignore what cannot be measured. This leads to missing variables in strategy models. While we sympathize with strategy scholars in their idealism for hard-science, the question is if this fastidiousness is doing justice to the phenomena we intend to study or if it is blinding us.

5.3 Causality and the Problem of Reverse Causality

Inspired by the natural and physical sciences, strategy scholars in the dominant theories seek to establish strong causal links. However, studies have often proved inconclusive and the problem of reverse causality has often been a problem. So, while causal explanations are both sought and provided, the problem seems to be that the practitioner finds the assumptions unrealistic, and the explanations simplistic or plain wrong.

5.4 Predictive Ability

The hallmark of a good science has been understood to be in the strength of its predictive ability. Starting with Porter [1980], the emphasis on empirically driven predictability has however seen to have been either overlooked, or oversimplified. This is demonstrated adequately through the numerous examples of application of popular theory to disastrous effects, that of the experience curve theory on the British Motorcycle Industry being one of the salient ones. The question that needs to be asked is if predictive ability is an appropriate objective to seek in strategic management research?

5.5 Rationality

Much work in the behavioral tradition has conclusively broken the back of 'economic man', and as Levinthal [2011] suggests, we do not have an option but to model strategy as behavioral and assume rationality as a process. Current dominant theories in strategic management are clearly both at a theoretical disadvantage with their strong rationality assessment, as well as are distanced from much practitioner thinking on the subject. A behaviorally rooted model of rationality that accounts for adaptation is therefore crucial in any potential improvement in theorization of managerial action taking.

5.6 Methods Used

Epistemological understanding of nature determines the choice of methods used in research. The heavily quantitative measurement based ideology thus skews strategy researchers into mistaking their measures for the underlying phenomena that they are trying to model. The p-value driven research process exacerbates the problem by confounding the problem of measurement with the high levels of

confidence that come with highly significant level of coefficients obtained from regression.

5.7 Assumptions about the Purpose of Research

One of the primary questions that the philosophy of science raises is that about the purpose of research. When the strategy field came out of the economics and industrial organization departments into a field of scholarship of its own, the objective was clearly to enable the practicing manager better manage strategic decision making. As noted in the introduction of this article, this is an aspect that is not lost on scholars in strategic management. The question of how to remain relevant to practice has been one that has been debated several times in the best strategy journals. Why then, do we still see the glaring gap between research and practice?

5.8 Relationship with Other Studies

Philosophers of science have always also asked questions about applicability and interoperability of research with neighboring sub-fields. It is natural to expect that the various disciplines within business school build of each other, and into each other given that their fundamental object of research is the business firm, though the respective focus may vary. Strategy theories though seem to hang somewhat uncomfortably among theories of micro organizational behavior, financial capital allocation, microeconomics and to a lesser extent with organizational theory. Are the philosophical assumptions to blame? What may be done to work toward an integrated and continuously integrating theory of the business firm?

5.9 Summary of Philosophical Issues with Dominant Theories

In the discussion above, we identified and reiterated that the strongly positivist-empiricist philosophical underpinnings of much strategy theory was constraining researchers from being able to address the strategic reality of firms in the real world. We also saw the need for a consistent, and integrating approach but one that is not trivializing of the phenomena. Finally we see the case for plurality in both theorization and interpretation of phenomena.

6 The Case for Complexity Theory

We make the case that complexity theory may be considered to overcome the shortcomings of traditional strategy theory in bringing it closer to practice. We recognize that much of complexity theory will challenge the most basic assumptions of the positivist-empiricist researcher, while at the same time also realize that complexity theory may hardly be a panacea. Specifically, while traditional economic theory, and economics inspired strategy theory has been parsimonious and relatively simple, we may no longer expect that with the application of complexity concepts to strategic management problems. The question is if the tradeoff between additional complexity in theory is to be accepted so we may have a more integrative theory that is better at explaining the practical reality of strategic situations in firms. That is a question rather hard for an amateur doctoral student to try answer, but we do proceed believing that it may help the cause.

7 Essentials of Complexity Theory

Eisenhardt and Piezunka [2011] observe that there has been a paradigm shift from reductionist to a holistic perspective across disciplines, and that while pigeonholing was useful in the past, that it has had the eventual consequence of obscuring an understanding of emergent complex behavior (self-organization, nonlinear dynamics and power-law distributions of system-level phenomena). Maguire et al. [2011] further explain that organizations make up and operate in a Schumpeterian word of creative destruction - an under-determined social and economic reality which is not at, nor heading for, 'equilibrium'and in which behaviors cannot be interpreted as being 'optimal'. Complexity science thus, conclude Maguire et al. [2011], confirms that our world resembles an ecosystem or organism in the process of developing. By defining or clarifying the mechanisms by which micro-level interactions give rise to macro-level system structures, properties and behaviors, complexity theory provides the conceptual and methodological tools to handle emergence, self-organization, evolution and transformation [Maguire et al., 2011].

1. Complex systems consist of a large number of elements
2. These elements interact dynamically
3. Interactions are rich; any element in the system can influence or be influenced by any other
4. Interactions are nonlinear
5. Interactions are typically short range
6. There are positive and negative feedback loops of interactions
7. Complex systems are open systems
8. Complex systems operate under conditions far from equilibrium
9. Complex systems have histories
10. Individual elements are typically ignorant of the behavior of the whole system in which they are embedded

Table 1: Features of Complex Systems, Adopted from Cilliers [1998]

8 Philosophical Characterization of Complexity Theory

McKelvey [2011] suggests that realism allows elements of positivism and relativism to flourish in social science. Specifically McKelvey [2011] identifies four characteristics, 1. dealing with metaphysical terms, 2. objectivist empirical investigation, 3. recognition of socially constructed meanings of terms, and 4. a dynamic process by which a multi paradigm discipline usually reduces to fewer but more significant theories. This classification directly addresses the shortcomings of the philosophical assumptions of the dominant theories in strategic management discussed earlier.

8.1 A new view of Ontology and Epistemology

"While classical science considered an ontology of isolated objects, complexity theory considers an ontology of connected entities i.e. a network which has links that change, nodes that change internally and capabilities that develop and change over time. Complexity scholars recognize that often both the model and the mod-

elers are not outside the system being modeled but within." Maguire et al. (2006: 197) suggest that the shift away from elegant mathematical representations of idealized processes to agent-based computational models allows organizational researchers to pursue the epistemological advantages of models and experiments while not having to assume away important or essential features of organizational reality simply to make the mathematics tractable. We may therefore now create models that assume a) idiosyncratic heterogeneity among individuals or firms (which had previously been assumed to be homogeneous to keep the mathematics manageable), b) interdependence among agents (which was previously eliminated, assuming agent independence), and c) the emergent nature of agent interactions (which was previously ignored to keep the variables at a single level of analysis). This therefore allows us to create rich, life-like models and therefore address the significant shortcomings of extant theories dominant in strategic management research.

Eoyang [2011] reflects on complexity as an epistemological and ontological phenomenon suggesting that complex adaptive systems work against a backdrop of an ever-changing context, that therefore precludes the opportunity to separate what is happening from one's ability to know what is happening. Therefore at such a time, the boundary between ontology and epistemology is seen to blur. Eoyang [2011] therefore concludes that practitioners would see thinking and real-world causality merge when engaging in an adaptive complex environment.

In summary, with complexity theory we are able to break out of the barriers of the positivist-empiricist philosophical stance, and allow our agents to be modeled more richly, for emergent effects to surface, and for ontology and epistemology to also keep up with the changing world.

8.2 Prediction vs. Explanation

Positivism and realism differ in yet another dimension that informs science's criterion for acceptance of a theory. While positivist views require predictive power of the theory as a necessary condition, the realist view is that the absence of predictive power does not threaten the scientific status of the discipline. Realism instead focuses on the explanatory power and associated understanding of the phenomena under study. This is an especially useful construct in the context of social sciences where conceptions of human agents can themselves serve to reshape the phenomena under study. In that sense, the future is not knowable in the form of accurate predictions. The future does not exist in the present in the sense that it is awaiting discovery by a human agent. Instead, under the realist worldview,

multiple possible futures are thought to exist. Richardson [2011] suggests that the adoption of complexity theory is likely to lead to a renewed interest in philosophy (including of ontology and epistemology) since causality is "complex, intricate, multi-ordered, and intractable in an absolute sense".

8.3 Implications for Methodology

The realist philosophical stance as applied to complexity theory described above has significant implications for the methodology for the conduct of research. First, with the possibility for ontology to change, and with it the epistemology, and for the distinction between the two to blur when engaging with an adaptive complex environment, traditional mathematical models may no longer be appropriate. Computer models and simulations may now replace the traditional mathematical models. However we do expect that agent level or other atomic level behavior be succinctly and parsimoniously described as a finite state automaton. Stochastic models and interventionist models may also be incorporated depending on the nature of the phenomenon under study. A number of options open up that allow researchers a finer level of understanding, though it must be noted that this increase in explanatory power comes with both lesser parsimony in the theorization, and less determinism about the detailed states.

8.4 Pluralism

The adoption of complexity theory lends itself to pluralism at multiple levels, primarily because of the philosophical flexibility that is inherent in the framework. Richardson [2011] suggests that complexity theory may be characterized as three schools: Neo-reductionist, Metaphorical, and Critical Pluralist each of which differ in the extent of plurality allowed, with the critical purist the most generous. The plurality, depending on the context may exhibit behavior as co-operation, competition, sustenance or survival depending on the conditions.

Eisenhardt and Piezunka [2011] suggest that two principal propositions are central to complexity theory; first that there is an optimal amount of structure (rooted in the efficiency vs flexibility trade-off (Davis et al., 2009), and second concerning the relationship between optimal structure and the environment - As environmental unpredictability decreases, greater efficiency and so more structure become advantageous and vice versa. The optimal degree of structure (and the robustness of its range), therefore, depends upon the unpredictability of the environment (Eisenhardt and Sull, 2001)

1. Just because it looks like a nail doesn't mean you need a hammer
2. Decisions made by the many are often better than those made by a few
3. Expect to be wrong (or at least not completely right)
4. Flip-flopping is OK

Table 2: The laws of complex organizational management, Adopted from Richardson [2011]

9 Comparison of Dominant Strategy Theories with Complexity Theory

In conclusion, we would like to present a comparison of the philosophical underpinnings of the theories that dominate the strategy area today, and the complexity theory that we propose in this article. This is depicted in figure 3

Complex RBV: Critical but Difficult Features of the RBV and Key Features of Complex Systems

Key Features	RBV	Complexity
Creativity/adaptivity	Competitive advantage grows from latent creative potential embedded in firm resources	Complex adaptive systems learn and create new responses to their contextual environment
Complexity and ambiguity	Inimitability arises from social complexity and causal ambiguity	Living systems are composed of complex interrelationships that are nonlinear, nondeterministic, and unpredictable
Disequilibrium, dynamism, path dependence	Complex relationships build over time and are historically dependent; disequilibrium is the creative state; dynamism and process issues are paramount	Systems thrive and create at far-from-equilibrium states; equilibrium leads to stagnation, decline, and death; history matters; paths unfold irreversibly through time
System-level resources	Some key strategic resources are intangible and exist only at the system level, in relationships	Some elements only exist at the system level, in the dynamic relationships *between* things

Figure 3: Comparison of RBV and Complex Adaptive Systems, Adopted from Colbert [2004]

10 Limitations

Human affairs are indeed incredibly complex, and any single individual would be hard stretched to believe that one could comprehend much of the complexity that is withing business firms, much less provide practical models for their understanding. In presenting this study, I am keenly aware of my limitations as a single agent attempting to understand the complex larger system. In keeping with complexity theory, I hope to evolve, adapt and learn to perceive and interpret the complex social world of business firms in the years ahead. However, there are a few glaring limitations to the current study that need to be highlighted. Firstly, the study is not intended to belittle the monumental work done by towering scholars in the strategy area. If we are able to see as far as we are today, we owe it to these scholars over the decades who have simplified, abstracted, and debated our construction of the reality of the business firm. Second, complexity theory is itself an elaborately broad topic that one may not expect to do justice to the many dimensions to this field of inquiry in an entire lifetime, much less in a dissertation, and infinitesimally less in a philosophy of social science term paper written under a time constraint. It is therefore only an initial attempt at assessing the attributes of complexity theory to the application in problems of strategy. Third, philosophy and philosophical constructs and indeed much of the metaphysics surrounding our endeavor as philosophers of science is extremely abstruse and indeed a slippery slope. As one with little formal training in philosophy, I accept any errors made here with the utmost humility. Finally, I realize that it was an optimistic decision to both critique dominant theory as well as propose and expound complexity theory within the same term paper. I was motivated by my own interest in figuring out answers to questions that will become important in choosing my dissertation topic, and while I think I have helped my cause, the term paper has turned out less deep and substantial that I would have liked. That counts as yet another lesson learnt.

11 Conclusion

The possibilities of applying complexity approaches to strategy problems seem extremely promising. Specifically, the availability of computing power, and the ability of personnel in firms to work with computers allows us the possibility that management theory can grow out of the traditional limitations of mathematics and economics, and expand to modeling on behavioral and complex adaptive systems.

The philosophical assumptions in such an approach are less stringent, and more inclusive and plural. Prof. Abhoy Ojha has argued for, and instilled in us an appreciation for a diversity of approaches as seems to be the way of nature. With the application of complexity theory with all its flexibility, one hopes that the strategists in both academia and in industry will be better served.

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