NOVELTY AND APPROPRIABILITY: THE ROLE OF ENTREPRENEURIAL KNOWLEDGE IN SHARING INFORMATION

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ABSTRACT

Why do entrepreneurs share information? This paper examines why entrepreneurs share information when others can steal their ideas. I present an information sharing framework which builds on the assumption that ideas are abundant and of predominantly poor quality. Rather than hold ideas as stable constructs, the framework examines the case where profiting from innovation is related to the complementarities of specific assets, facing the “lemons” selection problem under conditions of novelty. In building the framework I introduce the construct of entrepreneurial knowledge to address the theoretical disconnects between (1) economic models addressing quality uncertainty and information asymmetry and (2) entrepreneurial models of appropriability. The evidence for entrepreneurial knowledge is illustrated in both a historical example, and illustrated from primary data. The implications of this framework on key topics in strategy, knowledge management, and entrepreneurship are also discussed.

“Don’t worry about people stealing your ideas. If your ideas are any good, you’ll have to ram them down people's throats.” Professor Howard Aiken, Inventor of the Harvard Mark 1

INTRODUCTION

Why do entrepreneurs share information? A fundamental concern to entrepreneurs, and academics alike, is that someone will steal their idea. This concern is so pervasive it is represented across a broad range of theoretical disciplines, from utilitarianism theories of social welfare and labor economics, to philosophical theories of justice, personhood, and individual identity (Fisher, 2000). In information economics, the concern for the theft of ideas is named the fundamental paradox of information (Arrow, 1971). Arrow’s fundamental paradox argues that there is the problem of opportunism in the sharing information as information must be shared to be valued, but after it is shared it has no additional value (Williamson, 1985).

The problem of Arrow’s fundamental paradox has been recognized in some form for hundreds of years (Granstrand, 2000), and is reflected in a broad range “intellectual property rights” theories and practices. It argued that when intellectual property rights are available and strong, the problem of information sharing can be ameliorated and the entrepreneur can benefit from a “market for ideas”, rather than from product markets (Gans & Stern, 2003). Yet, in most industries, formal intellectual property rights play a small role in the appropriation of innovation (Cohen, Nelson, & Walsh, 2000; Levin, Klevorick, Nelson, & Winter, 1987), and many firms “freely reveal” much about their innovations to rivals (Harhoff, Henkel, & von Hippel, 2003). Similarly, information sharing from cold calling is pervasive, from entrepreneurs (Birley, 1985) through to venture capital firms (Shane & Cable, 2002).

While histories of entrepreneurship are replete with stories of stolen ideas, they tend to focus on the hazards of information sharing rather than the motivation for sharing information.
Implicitly, these histories have adopted two simplifying assumptions. First, history typically treats ideas as stable constructs. Implicit in this notion is that entrepreneurs did not update with new information, even under early conditions of uncertainty. Second, the literature treats ideas as valuable. Implicit in this notion is that ideas were scarce and were of relatively low cost to assess.

The simplifying assumptions of historical narratives are useful for understanding the economics of more mature technologies, but they don’t help us understand why entrepreneurs share information. This paper presents an information sharing framework which assumes that in the early stages of entrepreneurial activity ideas are abundant and of predominantly poor quality (Stevens & Burley, 1997). The framework examines the case where profiting from innovation is related to the complementarities of many potential specific assets (Teece, 1986), facing the “lemons” selection problem under quality uncertainty (Akerlof, 1970). The information sharing framework proposes that entrepreneurs share information to identify novel combinations of complementary assets (Schumpeter, 1962; Teece, 1986). As information is very difficult to transfer when novelty is high (Carlile, 2004), appropriability is driven by “entrepreneurial knowledge” about the quality of different complementary asset combinations, and not from hazards of information sharing. Thus, under conditions of high novelty, the use of entrepreneurial knowledge leaves only those sharing information in non-novel relationships to suffer from the fundamental paradox.

DO ENTREPRENEURS PROFIT FROM SHARING INFORMATION?

Many histories of technology entrepreneurs have demonstrated that the firms who are the first to commercialize new product or process innovations often profit less than competitors and imitators (Schumpeter, 2001; Teece, 1986). Teece has explained that the share of profits from innovation will depend on three factors: (1) the appropriability regime, (2) the maturity of the technology design, and (3) access to specialized complementary assets. Teece (1986) argues that when the appropriability regime is strong, through effective intellectual property protection or when products and processes are hard to imitate, profits will typically accrue to the innovator. But when the appropriability regime is weak, profits will accrue to the owners of specialized complementary assets, or to firms that can contract to access them.

Gans and Stern (2003) extend Teece’s classical analysis to propose that the principle challenge that technology entrepreneurs face is that the owners of complementary assets have the greatest incentives to imitate the innovator. They argue that when innovation value is reinforced by existing complementary assets, innovators will use a “marketplace for ideas” (p.341). When the technology is excludable, innovators will share information when they can increase their bargaining power by “credibly threatening to pursue an idea with a third party” (p. 338). And when the technology is not-excludable, innovators will choose to cooperate when “incumbents foster a reputation for ensuring mutual advantage” (p. 334).

Both the Teece (1986) and the Gans and Stern (2003) frameworks orient their concerns to profit losses that derive from competition and imitation. In both frameworks the implicit assumptions are that novel innovations are relatively well defined constructs, of high quality, and with known dependencies to “requisite complementary assets” (Teece 1986, 297). Under these assumptions, complementary asset holders have incentives to steal ideas and create disclosure hazards for entrepreneurs sharing information.

However, an alternative approach is that novel innovations are poorly defined constructs (Carlile, 2004; Hargadon & Sutton, 1997) that suffer from quality uncertainty (Akerlof, 1970;
Scherer, Harhoff, & Kukies, 2000). Under these assumptions, innovators possessing private information about their inventions may signal that their ideas are of low quality, or “lemons”, simply by offering them for sale (Akerlof 1970). As complementary asset holders similarly hold reciprocal private information, the dependencies between the complementary asset holder and innovator are difficult to recognize and value. In more general terms, the value of a novel relationships around any innovation is going to be difficult to recognize and assess by either party (Carlile, 2004; Hargadon et al., 1997). Instead of labeling the problem of an innovator attempting to access complimentary assets (Teece, 1986), under these more general assumptions, both parties have disincentives for stealing ideas (as most ideas are lemons), but instead face selection hazards in novel asset combinations.

The theoretical notion that the sharing of novel information, such as an idea, negatively impacts appropriability is widely held and relatively uncontested (an exception is (Anton & Yao, 1994). It is this theoretical lens that is most consistent with the “lone inventor” narratives that form a commonplace understanding of system of innovation and intellectual property rights (Seabrook, 1993). However, as I’ll demonstrate, the narrative of the lone inventor can be misleading in regards to appropriability when assets are not considered (Teece 1986). In this paper I reexamine the case of the Kearns’ intermittent windshield wiper, an often cited as an exemplar of the lone inventor and stealing ideas problem (Gans and Stern 2003), to suggest appropriability is less affected by information sharing than selection hazards in novel asset combinations.

Information, Imitation and Appropriability

The Kearns’s intermittent windshield wiper case is the exemplar case of the lone inventor going up against big corporations for stealing his idea. The original windshield wiper was invented in 1903 by Mary Anderson of Birmingham, Alabama (Wohleber, 2007) after she experienced a snow storm in a New York city street car. By the early 1960’s there had been many windshield wiper innovations including dual-wipers, washer fluid dispensers, variable speed wipers, and rear-wipers (2007). However, no one had solved the problem of blades constantly going across the windshield.

A solution would come from Robert Kearns in 1963. The invention of the intermittent windshield wiper had all the narrative components of a stolen idea. The invention had come to Kearns in a “flash of genius” (Seabrook, 1993). Kearns had badly injured his eye in 1953 on his wedding night by an errant champagne cork. While driving his Ford Galaxie, nearly ten years later, the constant wipers strained his vision and made him recognize the need for a intermittent wiper (Wohleber, 2007). After building a prototype and hiding the mechanism in a sealed red box, Kearns approached Ford. He demonstrated the invention to ten Ford engineers and found he had Ford’s interest (Seabrook, 1993). Following many months of his own testing and applying for patents, Kearns further demonstrated the invention to Ford where a Supervisor, Robert Shipman, told Kearns that he had “won the wiper competition” and that they would use the wiper on the 1969 Mercury line (1993, p. 44).

After Ford had expressed interest in Kearns invention, they requested more information from Kearns claiming they needed the full specifications because of government safety requirements. But 5 months after Kearns provided the full specification of the invention he was told that his wiper would not be used and that Ford had designed a different one (1993, p. 45). Devastated, Kearns moved and took a far-away job. But many years later, upon taking apart a windshield wiper from a 1976 Mercedes and seeing his design configuration, Kearns had a breakdown and was unable to work (1993, p. 47). In 1978 Kearns filed a patent infringement case against Ford which would come to trial 12 years later. Ford was then found by a jury to have infringed some
claims in a Kearns’ patent and Ford settled with Kearns rather than appeal (Reuters, 1990). A similar suit where Chrysler had in part, perhaps mistakenly, bound their legal fate to the Ford case, also found Chrysler to have infringed Kearns’ patent (Wohleber, 2007).

Over the many years Ford claimed that they had not stolen Kearns’ idea. Ford had substantial evidence for this position. First, when Kearns’ demonstrated his invention to Ford, Ford also demonstrated an intermittent wiper they had been testing since two years earlier. While Ford’s wiper was more costly and complex than Kearns’ design, they had already planned to offer it on some 1965 models (1993, p. 43). Second, when Kearns first met with Ford they had a minimum 10 person wiper team and had already established detailed performance specifications for intermittent wipers (1993, p.43). Ford had reviewed Kearns patents and felt that Kearns’ approach was both not patentable as it was obvious (1993, p.49) and different from the wipers Ford would later invent (1993, p. 46). Finally, when the contest to court, jury decisions in both the Ford and Chrysler cases found that patent infringements were not willful (1993, p. 51) which supports the view that both companies did not directly steal Kearns’ idea. Similarly Kearns’ lawsuits against many foreign car manufacturers were all summarily dismissed (1995).

In sum, understanding whether the sharing of information in this case affected the appropriability of this innovation is difficult to demonstrate from the historical case. For example, Kearns’ didn’t share information with foreign auto-manufacturers and yet they also sold the same innovation. All told Kearns didn’t share in any of the benefits received by many of the automakers using the invention. It’s therefore unclear if the hazards of information sharing (Gans et al., 2003) really explain the Kearns’ case.

**Selection of Novel Asset Combinations and Appropriability**

An alternative argument is that the value of most novel innovations is uncertain and predominantly of low or negative value (Scherer et al., 2000; Stevens et al., 1997). Under these conditions appropriating from novel innovation is less concerned with hazards of information sharing (Arrow, 1971), and more concerned with hazards of adverse selection (Akerlof, 1970). By beginning with the assumption that novel relationships are hard to assess (Carlile, 2004), I examine the Kearns’ case as a problem of selection between novel asset combinations.

From Ford’s perspective Kearns’ novel assets were poor quality lemons (Akerlof, 1970) and highly substitutable (Barney, 1991). First, if Kearns had any reputation prior to approaching Ford it would have been that of an inventor with three failed inventions (Seabrook 1993, p. 41). At a minimum Ford would not have had any reason to expect that they would get access to a talented inventor, and “as far as the (Ford) engineers were concerned, Kearns was a sort of pest… always stopping by the lab” and getting in the way (1993, p. 49). Second, Ford had more than two thousand suppliers with existing manufacturing capability (1993, p. 49), whereas Kearns had no experience with manufacturing. Ford also had a fully dedicated wiper team as well as a very established wiper supplier and knew the specifications of the requisite wiper better than Kearns (1993, p. 44). Third, Kearns windshield wiper model was built using common, off-the-shelf components that Ford could buy elsewhere (Wohleber, 2007). Finally, Ford had reason to believe that Kearns’ patents were of dubious value as: (1) between 1950 and 1975 “three out of four patents in the circuit courts were ruled invalid or not infringed” (Seabrook 1993, p. 40); (2) Ford patent attorneys determined that the patents were not patentable because of the generic nature of the components (1993, p. 44); and (3) Tann Corporation, an original licensee of the Kearns
patents, returned them to Kearns after electing not to sue Ford for infringement (1993, p. 45). All told, Ford didn’t have a compelling ex ante, or beforehand, reason to think that Kearns brought high quality novel assets to the relationship.

From Kearns’ perspective Ford’s novel assets were also of poor quality. First, Ford had a well known reputation for not licensing patents after busting the Selden patent in 1911 (1993, p. 48) and had a reputation of not working with inventors (1993, p. 50). Second, Ford was a technology laagered in windshield wiper technology (1993, p 43), lagging both Trico and Chrysler. Third, the intermittent windshield wiper option didn’t sell on Ford cars when it was introduce as a stand-alone option in 1969 (1993, p. 47), though later Ford would find that it sold well when packaged with the remote-control mirror. Finally, Ford already had licenses with Trico, an experienced supplier which continues to be the worlds largest, providing it with an intermittent windshield wiper (1993, p. 34).

In sum, if novel combinations of assets (Schumpeter, 1962), and less generally access to complimentary assets (Teece, 1986), provide opportunities for appropriability it would appear that neither Kearns nor Ford have anything but poor quality assets relative to each other.

An Anomaly in the Lone Inventor Narrative

A final example is illustrative of the differences between the imitation and selection perspectives. While many of the histories repeat that Kearns wanted nothing but “the chance to run a factory with his six children and build his wiper motors” (Schudel, 1995), Kearns did actually license his invention for a period of time. After Kearns had tested his invention and found that it met Ford’s detailed specifications, “he called Ford with the good news but Ford didn’t seem overexcited” (Seabrook, 1993, p. 44). Now, running short of money for his components and his patent applications, Kearns met with Dave Tann a principle at a mid-size car part supplier called Tann Corporation (1993, p. 45). Dave Tann drove Kearns’ car with the intermittent wiper and was very excited by the technology. On the spot, Dave Tann gave Kearns his Cadillac, and the agreement that Tann Corporation would pay Kearns $1000 a month to continue R&D. Additionally Tann Corporation would take over the cost of getting the patents, and pay Kearns royalties when the wiper went into production. Kearns returned home with a Cadillac and a prepayment for his first year of $12,000.

The reason this case is important is that Kearns shared more information with Tann Corporation than Ford had initially received. Yet, in this case Kearns negotiated a satisfactory license under an even weaker intellectual property position than Kearns held when he was later thwarted by Ford. From information sharing perspective, Tann had more incentives to steal the idea than Ford because: (1) Tann’s business was not as dependent on supplier relationships relative to Ford so their reputation was less valuable, (2) the intellectual property was not yet developed so the rights were not as certain, and (3) unlike Ford, Tann had no other supplier of a substitute technology. Yet, from novel combinations of assets perspective, Kearns offered Tann Corporation novel expertise, a novel prototype and a novel opportunity to use their manufacturing base for a new business. Tann in turn, offered more than just potential royalties. Tann offered Kearns R&D support and patent support primarily through the use of Tann’s patent attorney.
DEVELOPING A THEORY OF ENTREPRENEURIAL KNOWLEDGE

The purpose of this paper is to understand how information and novel assets interact to affect appropriability. The existing literature on complementary assets and information (Gans et al., 2003; Teece, 1986) can’t differentiate the appropriability conditions between: (1) Kearns sharing information with Ford, and not licensing, and (2) Kearns sharing even more information with Tann and licensing. In more general terms, why do entrepreneurs, angel investors, venture capitalist, and others involved with novel innovations share so much information, often with people they don’t even know (Birley, 1985), or even with potential competitors where they have no expectation of reciprocity (Allen, 1977; Shane et al., 2002). In this section I briefly review how different literatures relate the concepts of information, assets and appropriability. I define a novel construct, entrepreneurial knowledge, a relational form of rival, tacit and pragmatic knowledge that exists under conditions of high novelty. I’ll describe how differences in entrepreneurial knowledge can differentiate the appropriability conditions between Kearns relationships with Ford and Tann before examining two implications of entrepreneurial knowledge.

Information and Assets in the Context of Appropriability

It is known from Teece (1986) that when imitation is easy the profits from innovation accrue to owners of complimentary assets. The corollary of this point is that when imitation is hard the profits of the innovation will accrue to the innovator, the de facto “owner of the innovation.” This implies that any entrepreneur who both owns the innovation and has access to the complimentary assets, which by definition are specialized (Teece, 1986; Williamson, 1985), will be expected to appropriate from the innovation. Restated, any entrepreneur owning the right combinations of specific assets will appropriate from an innovation regardless of imitation conditions.

The key role of specific assets in Teece’s (1986) argument suggest that a change in resource configuration (Barney, 1991; Penrose, 1995) has primacy over arguments of imitability (Arrow 1971). The implication of this argument is that examinations of information heterogeneity and changes in information configurations (Arrow, 1971; Gans et al., 2003; Hayek, 1945), so fundamental in the entrepreneurial literature (Fiet, 2002; Kirzner, 1985; Schumpeter, 1934; Venkataraman, 1997), are secondary considerations in regards to appropriability. This is not to suggest that changes in information do not play a role in either resource configurations or appropriability. I argue that only that specific information conditions, I describe as entrepreneurial knowledge, can help to explain appropriability.

Information, Novelty, and Entrepreneurial Knowledge

The fundamental disconnect between the role of information heterogeneity (Hayek, 1945) in appropriability and resource heterogeneity (Barney, 1991; Penrose, 1995) in appropriability is where to place the problem of novelty. Most entrepreneurial theories of innovation associate novelty with the idea or the information changes associated with innovation (Arrow, 1971; Fiet, 2002; Gans et al., 2003). There are currently three different literatures that associate novelty with information heterogeneity (Table 1).

In the information economics literature, the novelty of information moves up a scale from public, or common information such as that represented in efficient markets (Fama, 1970), to private information (Fiet, 2002), to specific information of time and place (Fiet, Piskounov, & Patel, 2005; Hayek, 1945). Fiet (2007) suggest that this information can be assessed against an entrepreneurs’ “epistemic structure” to identify valuable ideas that other entrepreneurs might not
recognize. This view takes into account earlier views on the role of prior knowledge in discovery (Shane and Cable 2002).

In the knowledge management literature, the novelty of information is represented as information associated with novel action (Nonaka, 1998). Some knowledge, such as explicit knowledge, can be readily transferred to others, whereas other knowledge is tacit and difficult to imitate. The implication of this view is that individuals possessing more tacit knowledge may accrue advantages from novel knowledge that is difficult to codify.

Both the information economics and knowledge management literature objectify novelty as a construct associated with an individual actor. A third view is the knowledge boundary literature which treats knowledge as a relational property associated with the actions two or more actors (Carlile, 2004). The knowledge boundary literature examines knowledge within the context by which actors can share and assess knowledge. Carlile (2004) associates novelty as a condition of knowledge boundaries between actors arising from syntactic knowledge transfer problems, semantic knowledge translation problems, and pragmatic knowledge transformation problems. Under the highest novelty conditions actors are not only misrecognizing differences, but are doing so because they are assessing the knowledge boundaries in relation to their own interests.

The knowledge boundary literature has been primarily studied under single firm conditions where individuals in may have different interests, but are not addressing firm level appropriability concerns (Carlile 2002). However, entrepreneurial settings are a more extreme case because actors still possess individual level differences (Fiet 2007), but also at the same time must address firm-level appropriability. Referencing back to the Kearns case, novelty may arise through considerations of novel firm-level combinations of assets, rather than just through individual difference in knowledge. What I suggest is that by considering novel asset combinations, entrepreneurs share information to assess the degree to which knowledge about the asset combination is rival, tacit, and pragmatic. This type of knowledge, about novel asset combinations, I call entrepreneurial knowledge.

Entrepreneurial knowledge is unique in that relates to information problems, but only to the degree that those information problems arise from novel combinations of assets. Relating to the earlier case, I argue that because Kearns and Ford could not identify novel asset combinations, neither party could develop entrepreneurial knowledge when they shared information. Without a novel asset combination, and resultant entrepreneurial knowledge, neither party could appropriate from a license. Alternatively, by sharing information and identifying novel asset combinations, Kearns and Tann could both develop entrepreneurial knowledge about the opportunity, which in this case lead to a license.

While entrepreneurial knowledge is not sufficient to fully appropriate from an innovation, particularly because it is still based on incomplete and asymmetric information under conditions of uncertainty, it can distinguish appropriability conditions between different asset combinations. Similarly, a information sharing framework anchored on the concept of entrepreneurial knowledge proposes that entrepreneurs should engage in much information sharing (Birley, 1985; Shane et al., 2002) rather than facing concerns from Arrow’s paradox (Gans et al., 2003).

NOVELTY, COMPLEMENTARY ASSETS, AND ENTREPRENEURIAL KNOWLEDGE

The entrepreneurial knowledge and the information sharing framework has three major implications in understanding what entrepreneurs do. First, if information changes impact
appropriability through entrepreneurial knowledge, than we would expect expert entrepreneurs in the early stage to retain novel asset combinations more than ideas. Second, if entrepreneurial knowledge is highly relational, we would expect expert entrepreneurs in the early stage to select across many potential novel asset combinations to mitigate the lemons problem. Finally, if entrepreneurial knowledge is important, we would expect to find that it relates to appropriability.

To illustrate the role of entrepreneurial knowledge I choose two salient cases from a study of 59 highly novel opportunities, assessed by 15 repeat entrepreneurs, 7 in Boston and 8 in Northern California. Repeat entrepreneurs are defined as having a minimum of three successful ventures or one successful billion dollar venture (Fiet, 2007). The first case examines the early stages of a novel high-growth business that was co-founded by a 76 year old Boston entrepreneur who had previously founded a multi-billion dollar company, several startups, and was an active angel investor. The second case examines the early stages of a successful social entrepreneurship business founded by a 31 year old entrepreneur that has founded, or co-founded, seven successful businesses, two ongoing inventor organizations, and won multiple prestigious inventor awards.

Ideas vs. Complementary Assets

In the first case I propose that in the very early stages expert entrepreneurs assess opportunities in the context of novel asset combinations. Figure 2 is a portion of an interview explaining how a novel opportunity was assessed. Initially the entrepreneur considered a technology for tractor tread based on a unique shaped of a pin joint. He recruited and co-founded a company with an individual who owned a business with substantial machine tool assets. They approached caterpillar and a number of other companies, as well as VCs, but found little interest (not presented). Then, in a flash of insight the entrepreneur realized that assets he already had access to would be more valuable than that of his partners, and radically changed the idea to one that required specialized semi-conductor assets. The co-founder didn’t leave the venture; rather his unique contribution was redefined not as machine tool access but as management skill.

In this particular example nearly every attribute of the opportunity that a scholar might think to measure in this two person firm is radically transformed. There are radical changes in the idea, the technology, the patents (not presented), the roles of the co-founders, and the target market. However, the novel assets of the firm are invariant through the early stages and are reconfigured to match new information that the entrepreneurs find in the discovery process. From this I propose:

Proposition 1: Once a firm is founded, complimentary asset combinations are relatively invariant to ideas.

Entrepreneurial Knowledge and the Lemons Problem

If complimentary asset combinations are relatively invariant given other founding conditions, a question is do entrepreneurs select across many potential asset combinations prior to firm formation? In the second case I propose that in the very early stages expert entrepreneurs assess many novel asset combinations and that this has performative implications for the firm.

In Figure 3 I show that an inventor-entrepreneur assesses over 1200 potential asset combinations to develop a new opportunity. This “first of its kind”, successful, social entrepreneurial firm, develops invention cartoons for young inventors, as well as other social products for developing nations. In the firms early stages earliest stage the inventor and co-founder had no experience or idea how to assess the quality of illustrators that they needed to
make the cartoons appealing. Similarly they knew very little about the publishing market. Rather than develop their venture in secret, they made their early work available on the web, and posted a open call for illustrators. Over 200 illustrators in turn shared information about their interests and skills, and provided samples of their prior work. Similarly, the entrepreneur approached a number of publishers, a number of whom were interested but did not feel that their business would adequately support such a novel venture. Rather than steal the idea, a number of publishers that were initially approached recommended alternative publishers, helping the inventor narrow their search to only about a half-dozen publishers who might be interested in the project. I propose:

Proposition 2: Entrepreneurs share information to assess entrepreneurial knowledge about complimentary asset combinations.

All told, this venture of two people considered over 1200 potential combinations of potential complimentors. The entrepreneur openly shared information about his project to maximize the number of potential complementary assets he could evaluate. By doing so, he eventually picked a combination of partners leading to an outcome that was “better than perfect.” Within a month of its initial launch the first book from the venture was first in sales in three different categories on Amazon.com, and top ten in two more. I propose:

Proposition 3: Higher degree of entrepreneurial knowledge, the greater the potential for appropriability.

DISCUSSION

This article attempts to provide a theoretical rational for why expert entrepreneurs are so interested to share information, when novice entrepreneurs and academics are (overly) concerned about others stealing information. I propose that when entrepreneurs share information about novel asset combinations, they can develop rival, tacit and pragmatic “entrepreneurial knowledge” without concern for loss of appropriability. However, entrepreneurs can only improve entrepreneurial knowledge if the asset combinations are actually novel. So while sharing information can provide potential benefits in improving entrepreneurial knowledge, it can also help entrepreneurs to identify if asset combinations are highly imitable, and therefore lacking in potential appropriability.

Entrepreneurial knowledge is an important construct because it shifts attention from “hoarding information” theories (Aldrich, 1979; Campbell, 1960) about appropriability to theories which address specific asset configurations in addition to novel information. There are a number of reasons why this is useful. First, a “more novel information is better” approach is subject to increasing mis-information costs (Ackoff, 1967) and search costs (Fiet, 2007). Second, entrepreneurial knowledge anchors novelty in a place where it is more tangible (Schumpeter, 1934) and therefore easier for both researchers and entrepreneurs to assess (Carlile, 2002). Finally, entrepreneurial knowledge shifts attention from the ex post moral hazard problem of information disclosure (Arrow, 1971) , typically associated with agency and monitoring (Jensen & Meckling, 1996), to the ex ante selection problems associated with entrepreneurial markets (Akerlof, 1970) and development (Schumpeter, 2005).

This article is subject to number of limitations. First, the historical record regarding the Kearns’ windshield wiper is complex and continues to be contested. Second, the construct of entrepreneurial knowledge has not been directly observed as much as it has been inferred from anomalies in specific cases. Third, the cases chosen are not representative of the population in general, and may not even be representative of many entrepreneurial processes. The cases are
chosen to be illustrative and to ground the theory in more tangible phenomena.

CONCLUSION

A disproportionate amount of attention has been paid to the value of the “idea” in innovation, despite the generally accepted demonstration that appropriation is not in the idea but is determined by the ownership of complementary assets (Teece, 1986). Despite its lack of intuitive appeal, the implications of this simple and demonstrated premise (Teece, 1986; Winter, 2006) is that if a complementary asset holder can imitate the innovator, the innovator won’t appropriate from the innovation whether they share information about the innovation or not.

However, the role of entrepreneurial knowledge is important because it provides a pragmatic and theoretical rationale for the sharing of information under hazards of opportunism. When an entrepreneur has established a prior position in complementary assets, including the special case where entrepreneurial knowledge emerges from high novelty, information sharing does not affect appropriability. By examining entrepreneurial behavior as seeking novel combinations of complementary assets under conditions of quality uncertainty, the framework shifts our attention from debates of intellectual theft, to a framework of complementary asset selection. The implications of the framework are that entrepreneurs will profit only if they can select high quality, novel combinations of complementary assets, in relationships, organizations, and markets.

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REFERENCES


Figure 1: Knowledge, Information, and Entrepreneurial Knowledge
ENTREPRENEUR: I've been close to a guy who used to run the chemical engineering at TopResarchU. He said that he could build a pin joint, pushing with a pin, that didn't need lubrication. If you looked at the use of pin joints, for example any track vehicle has 70-some pin joints. They're sealed with a certain technology and are still the source of high warranty costs and maintenance. So he said he could build one that. So anyway, I got coincidentally a Ph.D. student who was graduating. The professor told me he was a fabulous engineer. So I got him to do some early work. He wanted to be a startup so he did some experimentation. And I've now recruited a fellow that ran a machine tool company in Cincinnati. And he wanted to be an entrepreneur. I've known him for many years. I got him to take a look at it. So he did some research and what we concluded is that in order to start a company around pin joints, even though the idea is fabulous, it would be very, very difficult.... So we're in the meeting and one area that I knew well, the market that I knew well, was electrical connectors. So I said well, this is the same principal as electrical connectors. Right then and there we came up with a different way to build the connector by weaving the connector, I can show you pictures of that.

INTERVIEWER: The idea changed quite a bit.

ENTREPRENEUR: Well, yes, from pin joints.

INTERVIEWER: To electrical connectors.

ENTREPRENEUR: Yeah. I thought that was an opportunity to get this in a fab. I was in a business for 35 years in LargePublicCo, so I knew the business well and I knew there'd been many, many ideas proposed but none of them ever made it besides the fundamental fork and blade, which is the fundamental connection device. So anyway, it started an idea. I have a lot of friends in the venture capital business… I went to them and said you don't anything about connectors, we're a new industry that will develop in areas like wireless.... And we don't know anything about it and the other thing is your management team, at this point I had asked this fellow from Cincinnati to move here.

INTERVIEWER: Now was he still kind of the right person? Because he kind of had a very mechanical background (machine tools).

ENTREPRENEUR: Well, he knows a lot about mechanical stuff.

INTERVIEWER: Right. But sort of when you move to electrical connectors it's the same?

ENTREPRENEUR: No, it's not the same at all. Well, the only thing is that since this is a very different way to build a connector you had to build some machinery.

INTERVIEWER: I see. So he came in useful there.

ENTREPRENEUR: He was useful because he knew how to run a company.
Figure 3: Selection Across Many Asset Combinations Leads to “Better than Perfect” Outcomes

<table>
<thead>
<tr>
<th>How Many Opportunities Evaluated</th>
<th>'I advertised, this is something that I want, please send me examples, show you why you'd be called. I get 200 examples from people who drew large breasted naked girls being f*** by wolves right through to extremely puerile sort of Chachi and Richie type comics.'</th>
<th>'If you're tying down contracts with Jenna Jamison and Rush Limbaugh and basically 200 people like that you don't spend any time on the details.'</th>
<th>'You're talking about a slick group of less than a half dozen people in the country. I did meet with versions of those other ones but the versions of the other ones were in niches.'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Constraints</td>
<td>'He is not an obtrusive, give you the complete download in three minutes. Some people you can get a complete grasp on in three minutes some take a couple of years and he is definitely in the latter category'</td>
<td>'Then one year of the worst legal and most incompetent legal negotiations I think you can imagine. And I have a lot to do with that terribly. We went too quickly to lawyers.'</td>
<td>'This person just wants to sell a lot of books and get this launched on Discovery and is pretty hands off. She is a talent scout and she has about two days for talent that she got.'</td>
</tr>
</tbody>
</table>

1 'Better than Perfect' Illustrator

Evaluated 200 Potential Illustrators

1 Innovative Author

200 Innovative Authors Under Contract

10's of Potential Publishers

6 Good Publishers

More Innovative Authors Evaluated

1 Right Publisher