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No: 2013/03 December 2013

UNIVERSITY OF CAMBRIDGE

Centre for Technology Management Working Paper Series

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ABSTRACT

In this paper we explore theories of opportunity discovery/creation with reference to the research, development and commercialization process of disruptive innovations. We apply this distinction (and inferences drawn in prior literature) to a number of cases of disruptive innovation (DI), using both known and new examples from mature and emerging markets. We find that the features of opportunity discovery and creation are too closely connected to be separable among the innovations studied. This leads us to question the theoretical basis of this distinction and to revisit earlier theories of entrepreneurship for an account of the way entrepreneurs innovate both in their use of means and in their choice of ends, as supported by our evidence on disruptive innovations. The aim of the paper is to clarify both the nature of disruptive innovations and the generation of opportunities.

Keywords: Opportunity discovery, Opportunity creation, Disruptive innovation, Entrepreneurship

1. INTRODUCTION

An entrepreneurial opportunity has been defined as a situation "in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships" (Eckhardt & Shane, 2003: p.336). Although the concept of opportunity is core to the theories of entrepreneurship and economics, the fundamental source of opportunity remains an on-going debate (Alvarez & Barney, 2007; Dutta and Crossan, 2005; Gartner et al., 2003). While one stream of research indicates that opportunities exist as a result of market disequilibria and therefore can be "discovered" by people who are particularly alert to opportunities (i.e. entrepreneurs) (e.g. Kaisch & Gilad, 1991; Kirzner, 1973, 1979; Shane & Venkataraman, 2000), the other research stream asserts that initiatives by entrepreneurs are crucial to the emergence of opportunity and it is the entrepreneurs who "create" the opportunities (e.g. Gartner 1985; Sarasvathy, 2001; Shumpeter 1934; Weick, 1979). Three fundamental differences in the assumptions underlying the two views were summarized by Alvarez and Barney (2007) who infer contrasting practical implications for each. They argued that the perceived context of the entrepreneurs, whether of discovery or creation, would determine the effectiveness of the actions taken by entrepreneurs.

This dichotomous view of the nature of opportunities for entrepreneurs has seldom been challenged in the expanding literature on this topic. In this paper, we revisit some earlier theories of entrepreneurship (Freeman, 1984; Penrose, 1959; Stevenson, 2006) and take into account the theory of effectuation (Sarasvathy, 2001) to explore whether opportunity discovery and creation are separable processes in entrepreneurship. We examine relevant evidence by applying the distinctions made by Alvarez and Barney to six cases of

disruptive innovation. We show that all entrepreneurs acted in ways that involved both the discovery and to the creation of opportunities, although some cases feature more attributes associated with one process rather than the other by Alvarez and Barney. This exercise proves useful in clarifying the nature of opportunities for disruptive innovation and the possibilities for purposive innovations of a disruptive kind.

Disruptive innovation (DI) is a process by which a product or service takes root initially in simple applications at the bottom of a market or in a new market, and then relentlessly moves 'up market', eventually displacing established competitors. The term was coined by Christensen in his seminal publications in the late 90s and the phenomenon has attracted attention by both scholars and practitioners (Christensen, 1997; Christensen & Lindsay & Hopkins, 2010; Linton, 2004; Raynor, 2003). Theory of disruptive innovation has also been extended from its original formulation to a more general strategy for market expansion (Utterback & Acee, 2005). Although Christensen maintains that the theory of DI can be used to predict the trend or next generation disruption (Christensen, 2006; Yu & Hang, 2010), this has been disputed (Kostoff, et al., 2004; Tellis, 2006). By applying theories of opportunity to cases of DI, we show in this paper how technological disruptive innovations were carved out by the entrepreneurs through processes combining opportunity discovery and creation. This points to the potential for disruptive innovations of a purposive kind undertaken by entrepreneurs who recognize possibilities for DI and take effective action to exploit such opportunities.

In the following section, we briefly review two theories of opportunity and the comparison summarized in Alvarez and Barney (2007) and contrast underlying theories with some earlier concepts of entrepreneurship and with effectuation theory. The

methodology of the research reported here and the case analyses are presented. We go on to apply the distinction made by Alvarez and Barney to the cases of DI to see whether the evidence supports their framework. We discuss the findings of this study and conclude with recommendations for practice.

2. OPPORTUNITY DISCOVERY AND CREATION

The debate on whether opportunity is discovered or created originated in differences between the views of Schumpeter (1934) and Kirzner (1979). Schumpeter believed that exogenous shocks such as technological, demographic, and social changes disrupt market efficiency and entrepreneurs make use of their early access to such information to create new products, services or processes. Kirzner held that market disequilibrium persists as a result of the idiosyncratic and incomplete information held by individuals; accordingly, those who are alert to the market disequilibrium can develop a profitable new product or service, bringing prices back to market equilibrium. On the basis of these two theories, two streams of research on opportunity emerged.

The Kirznerian stream (or opportunity discovery stream) is better populated in the entrepreneurship literature (Gaglio & Katz, 2001; Shane & Venkataraman, 2003). Researchers in this stream focus on the "search" process to improve market inefficiency set off by information and knowledge asymmetry. They attribute the ability to recognize such information and overcome knowledge asymmetry to personal factors such as personality traits (Rauch & Frese, 2007), prior experience (Shane, 2000), motivation (Locke & Baum, 2007; Shane, et al., 2003), and cognitions (Busenitz & Barney, 1997). Researchers in the Schumpeterian stream (or opportunity creation stream) focus on the

way entrepreneurs enact opportunities in response to technological, political, regulatory, social, and demographic changes (Baker & Nelson, 2005; Gartner, 1985; Gartner, et al., 2003; Sarasvathy, 2001).

Barney and Alvarez (2007) argue that the two streams of research differ in their basic assumptions and yield different implications for opportunity identification and exploitation. They also identify three dimensions of difference in the assumptions of the two theories: 1) nature of opportunities; 2) nature of entrepreneurs; and 3) nature of the decision making context. They maintain that the discovery theory assumes that an opportunity exists independently of entrepreneurs, who *ex ante* differ in some important ways from non-entrepreneurs, and that the decision-making context is subject to risk, which (unlike uncertainty) can be calculated. They see this as implying that decision-makers can access information to anticipate possible outcomes and their probability. The opportunity creation theory, in contrast, assumes that an opportunity emerges along with the entrepreneurs' perceptions. The decision making context is uncertain so information needed to anticipate possible outcomes or their probability is unavailable.

Barney and Alveraz (2007) discuss seven implications of these two sets of assumptions - in the areas of leadership, decision making, human resource practices, strategy, finance, marketing, and sustaining competitive advantages. In the theory of discovery opportunities occur in pre-existing markets and their identification relies on the entrepreneur's prior knowledge or experience. The context of discovery is subject to calculable risk and information is available for prediction and risk control, making it possible to anticipate skill requirements. Such information also supports relatively complete and long-term strategies, the attraction of external funding and specification of

their marketing mix. However, once information about the opportunity is made public by the entrepreneur's actions, competitive imitation will soon follow. Hence to protect a new business the entrepreneur needs to achieve speed to market, maintain secrecy and erect other entry barriers.

In contrast, these authors see the theory of opportunity creation as assuming no pre-existing market inefficiency to be remedied. Thus entrepreneurs rely on their experience to detect a latent need and translate this into effective demand for their innovation. They draw on their charisma to evoke trust. Unable to predict the future, these entrepreneurs make decisions on an iterative, inductive, and incremental basis and engage in emergent and flexible strategy-making. They recruit general and flexible human capital, usually from their current social network, and raise funds informally. There is no pre-existing model of marketing; this emerges as part of the opportunity creation process. Finally, their competitive advantage lies in creating a unique business, which is hard to imitate and hence can be sustained by tacit knowledge and path-dependent learning.

With regard to some earlier concepts of entrepreneurship, the distinction made by Barney and Alvarez is consistent with the work of Sarasvathy (2001), on which Fisher (2012) also relies. The attributes Barney and Alvarez assign to opportunity recognition align with what Sarasvathy describes as a classic causation theory of entrepreneurship, while their account of opportunity creation aligns with Sarasvathy's effectuation approach. This approach involves "eliminating the assumption of preexisting goals." (Sarasvathy, 2001) held by entrepreneurs, who instead use the means available to them in pursuing opportunities in a creative and flexible way. A similar approach to means is taken in the theory of entrepreneurial bricolage, whereby entrepreneurs make do with available

resources in pursuing opportunities (Baker & Nelson, 2005). In contrast, entrepreneurs who engage in classic entrepreneurship based on causation premises are said to focus on 'selecting between means' to realize a given opportunity (Sarasvathy, 2001). This is a rational planning approach, which has been summarized for entrepreneurial startups as follows: "Some individuals are in a unique position to discover opportunities. *Once an opportunity has been discovered* [emphasis added], the potential entrepreneur assesses the commercial potential of the idea and" [depending on contingencies] "decides whether or not to start a venture. Investments and [preparatory] actions… follow the firm formation decision. Next a set of strategic choices is made covering the business model, partnerships, pricing and product line among others. After product launch, consumer demand [provides] feedback on its idea and enabling adjustments" (Shah & Tripsas, 2007).

Thus the rational planning approach has been depicted as the classic approach to entrepreneurial decision making by Sarasvathy (2001), by Shah and Tripsas (2007) and by Fisher (2012) among others. However there are earlier approaches to entrepreneurial decision-making that pre-date and differ from those presented by these authors, but could also be characterized as classic approaches to entrepreneurship. The definition of opportunity we provided initially characterized a situation in which innovations are introduced "through the formation of new means, ends, or means-ends relationships" (Eckhardt & Shane, 2003). This is implicit in classic writings by Penrose (1960) and Freeman (1982) who saw that entrepreneurial innovation involves a new matching of resources to opportunities, that is, a new configuration of means and ends. Penrose

detected this from the perspective of the entrepreneurial firm (Penrose, 1959) while Freeman's focus was on sources of innovation.

'Means' in Sarasvathy's analysis is a conceptualization of entrepreneurs' personal 'assets' based on who entrepreneurs are, what they know, and who they know. Fisher interprets means in Sarasvathy's analysis of effectuation as proceeding from what is given:
' "things over which the entrepreneur has control" - in particular knowledge, networks and resources' (Fisher, 2012). In complete contrast is an earlier definition of entrepreneurship as 'the pursuit of opportunity without regards to resources currently controlled." (Stevenson, 2006). It was based on extensive studies by Howard Stevenson, a pioneer in entrepreneurship studies. The rational planning approach was attributed by Stevenson not to entrepreneurs but to corporate managers who receive budgetary allocation of the resources needed to achieve approved objectives. While Stevenson recognized that rational planning methods could be, and are, applied in start ups, he did not see these methods as being classically entrepreneurial. Rather they implied attempts to use corporate rational planning methods in startup companies.
Thus pre-dating the two theories of entrepreneurship used by Barney and Alvarez, we find that earlier theories of entrepreneurship made a different contrast. Earlier writers compared managers who plan from the outset to achieve given ends by using rational planning with typically entrepreneurial innovators who configure new means-ends relationship in flexible and creative ways - through a shift in means, ends or both, typically pursuing opportunities before they have secured the necessary means to realize them. The approach of relevant authors is summarized in Table 1 below.

Table 1 Dichotomous approaches to understand entrepreneurship

Authors	**Characterisation of Entrepreneurial Innovation (and contrast with other modes)**	
Barney & Alvarez, 2007	Opportunity discovery (Kirznerian view)	Opportunity creation (Schumpeterian view)
Sarasvathy, 2001	Classic (Causation based) entrepreneurship: rational means used to achieve predetermined ends.	Effectuation – use of given means to achieve flexible ends
Shah & Tripsas, 2007	Classic entrepreneurship Rational means used to achieve predetermined ends.	User entrepreneurship Collective creativity, experimentation, adaption of ideas.
Eckhardt and Shane, 2003	Entrepreneurial opportunities	Involve "new means, ends, or means-ends relationships"
Stevenson and Jarillo 2001; Stevenson 2006	Rational corporate planning: select and secure appropriate means to achieve approved ends.	Entrepreneurial improvisation to secure resources unavailable on initial pursuit of opportunity
Penrose, 1959; 1960; 1971	Corporate planning: selected means to achieve approved ends.	Entrepreneurs engage in creative matching of resources (means) to market opportunities.
Freeman, 1982	Freeman disputed that innovation results *exclusively* from technology *or* market impetus.	Entrepreneurial innovation via matching of technological means to market opportunities.

In order to explore which theories of entrepreneurship best fit evidence on disruptive innovation, we set out to obtain relevant evidence from six cases of disruptive innovation.

3. METHOD

In comparing two different theoretical explanations of the opportunity emerging process, we followed the approach set out by Fisher (2012) of an alternative template research design (Langley, 1999) and applied the two theoretical perspectives discussed above to evidence from cases of disruptive innovation. We chose two earlier cases of disruptive

innovation (DI) (i.e. Seagate and Sony) and four relatively new cases from emerging sectors and markets (i.e. Suzlon, Luyuan, Tata swach, and ARM). For each case of disruptive innovation, we used not only published information, but also multiple interviews, conducted with the company founder and senior scientist or engineer in order to understand the R&D background and commercialization of the innovation. This makes it possible to triangulate information for each case, increasing the validity of the findings. The details on the cases and the data collected are reported in Table 2.

We compared the evidence from each case to the contrast theorized by Alveraz and Barney (2007). If the qualitative data in the case study matches the assumption or the inferred actions associated with the theory, we take this to show that the theory is a good fit in explaining the formation of the opportunity. The strength of the fit between the data and the theory is assessed by two criteria: 1) is it clear that the evidence on a specific assumption or action fits the theory? 2) Is the data in the case study clear and from multiple sources and unlikely to be contested by others reading the same information?

4. DISRUPTIVE INNOVATION CASES

4.1 Seagate

Seagate Technology pioneered the development of 5.25 inch hard disc drive in 1980 (Christensen, 1997). The 5.25-inch drives' capacities of 5 and 10 MB were of no interest to minicomputer manufacturers, who were demanding drives of 40 and 60 MB from their suppliers. In fact, except for their lower price and smaller sizes compared with the mainstream 8-inch drives, the 5.25-inch drives were inferior in all major performance aspects (i.e. storage capacity, average positioning time, average access time, and data

transfer rate). Instead of simply giving up, Seagate chose to create new applications for their products by reconfiguring conventional Winchester technology into a package size that could compete with 5.25” floppy disk. The use of hard drives became established in the desktop PC applications where small size, light weight, use of internal power supply and low cost unit were highly valued. Gradually, the capacity was increased to the level that was good enough for minicomputer and even mainframe markets. In this way the disruption took place and the 5.25” disk manufacturers became the new generation leaders.

Table 2 Description of the cases and the number of interviews conducted

Case	Seagate	Sony	Luyuan	Suzlon	Tata Swach	ARM
Country	U.S.	Japan	China	India	India	E.U.|
Founders	A. Shugart, T Mitchell, D.Mahon, F. Conner and S. Iftikar	Masaru Ibuka and Akio Morita	Ni Jie and Hu Jihong	Tulsi Tanti another founder is referred to in the case description – operations manager	Ratan Tata	12 engineers from Acorn Computers, Robin Saxby, Hermann Hauser
Year founded	1979	1946	1997	1995	2009	1990
Disruptive innovation	5.25-inch hard disc drive	Pocket transistor radio	Electric bike	Wind turbine and solutions	Water purifier	RISC Chip requiring low power
Interviews	3	1	3	4	2	8

Compared with other 5.25” producers, Seagate was extremely successful in establishing low-cost, high-quality manufacturing capacity, and in improving the speed and reliability of its 5.25 inch drives. An extensive marketing campaign and early success in obtaining licensing agreements from major firms such as Texas Instruments and Cii-Honeywell Bull led to the Seagate drive and interface ST506 and ST412 being recognized as defacto standards in the industry. The small company won contracts from IBM to supply disk drives for the IBM PC-2 and later PC/XT. Seagate knew that IBM and other computer manufacturers would press relentlessly for lower disk drive prices in exchange for the promise of future orders for the rapidly growing PC market. In 1982, three years from startup, Seagate began to assemble HDD components in Singapore, becoming the first firm in the industry to do so. Seagate became the world’s largest disk drive producer, reducing its costs on the basis of its Southeast Asian production base, in time for the fierce price competition in the subsequent years.

4.2 Sony

In the 1950s, the early transistor radios offered only poor performance and far lower fidelity than the vacuum tube-based tabletop radios. Nevertheless, Sony discovered a teenage market in the US that valued the pocket size and low price of transistor-based radios. This enabled teenagers to listen to Rock'n'Roll beyond their parents' earshot, though the music quality could not compete with tabletop radios (Morita et al., 1987).

Masaru Ibuka, one of the two founders of Sony signed an agreement with Western Electric to manufacture the transistor. But this agreement did not cover the technology and further R&D required to design and build a commercial portable transistor radio,

which became the responsibility of Sony engineers. First, with extensive research, they discovered that replacing the positive-negative-positive configuration to negative-positive-negative yielded a higher frequency response; but they could not find the appropriate material for this purpose. Although Bell Labs had failed at using phosphorus to replace antimony, Sony engineers persisted and eventually found a phosphorus doping method. Second, they had to redesign many electronic circuits to achieve low-power consumption. Third, in order to fit other electronics components into their small radio, almost every component needed to be miniaturized including the capacitor, the transformer, and the battery. Ibuka visited many component manufacturers in Japan and persuaded them to miniaturize each component from scratch. Fourth, to reduce the manufacturing cost, Sony designed and made their own printed circuit boards. Akio Morita, the other founder of Sony then decided on the US as their first target market, because Japan still lacked consumer demand for such a high-tech product.

Through its effective pursuit of miniaturization and compactness, within 3 years Sony introduced the world's first pocket transistor radio, in 1957. Starting with the transistor radio, Sony established unique core competence in product miniaturization which helped Sony to become a successful electronic business leader.

4.3 Suzlon

Suzlon, India's major wind power provider has become the world's fifth largest wind turbine manufacturer with a market share of 7.6%. Suzlon's founder, Tulsi Tanti, moved into the wind power business by chance. Unhappy with the erratic power supplies and rising energy costs at his textile mill in Gujarat, India, Tanti decided to give wind energy

a try. In the early 1990s, there was no wind energy developer in India. Tanti assembled his own team of four engineers from the textile plant and arranged for them to visit the existing wind farms in India for a month. Then they identified the vendors and equipment suppliers needed to build and install the first two wind turbines.

Tanti soon discovered that although the wind turbines could not provide the capacity of conventional power generators, they provided a reliable and cheaper source of energy. They were also environmentally friendly. Discovering this business potential, he made a bold decision to exit his textile business and set up Suzlon Energy in 1995 with a modest capital of $600,000. Suzlon's strategy has been to capitalize on India's low manufacturing costs and provide end-to-end customized solutions at affordable prices to its Indian industrial clients. From the outset, Tanti aimed to build a vertically integrated business – integrating every process in-house (i.e. R&D, manufacturing, installation, service, etc.) - so that he could better control the cost and collect feedback. After an extensive search, Tanti identified one small German company, Suedwind, which was willing to sell its technology for $1 million. Suzlon obtained ten turbines from Suedwind's inventory, and assembled the turbines with the help of the German engineers alongside their own two turbines. When Suedwind folded in 1997, due to financial difficulties, Suzlon bought it, retaining its R&D center and turbine manufacturing facilities in Germany. Shortly after, Suzlon acquired a rotor-blade manufacturer in the Netherlands; the acquisitions broadened Suzlon's reach, bringing a product range that included wind turbine generators in capacities from 350 KW to 2.1 MW with customized versions suitable for a variety of climates. In 2006, Suzlon acquired Hansen Transmission International – a world leading manufacturer of gearbox and drive trains for wind

turbines. In 2007, Suzlon acquired Repower Systems AG, a technology leader of multi-megawatt wind turbines. Leveraging R&D capabilities in Europe and low cost manufacturing capabilities in Asia, Suzlon managed to bring down the cost of their wind turbines to 20% below their European competitors. Meanwhile, their installation time was shorter and maintenance cost was lower than their competitors'.

All along, Tanti had very clear vision for his company: to bring down the cost of power to below that of gas. Suzlon's R&D, and strategy were designed for this purpose. Suzlon's products soon attracted customers with large manufacturing operations in rural areas that had poor or costly access to conventional power supplies. Suzlon's business grew rapidly in India and worldwide.

4.4 Luyuan

Beginning in mid-90s, a few visionary Chinese companies like Luyuan started to build a product which could better meet the daily transportation needs of the growing urban Chinese population. Although companies like Yamaha had already released E-bikes in the Japanese market, they were too expensive for the Chinese customers at that time. Reverse-engineering an existing E-bike model, the founders of Luyuan built their first generation E-bikes with motors, lead-acid batteries, battery chargers, and controllers in 1996. As most of the key components of the E-bike were available from suppliers in the market, Luyuan's assembled E-bikes were much cheaper than the Yamahas, although their performance was compromised. Nevertheless, due to its affordability and ease of use, Luyuan's E-bikes gradually attracted older customers and young mothers who used the bikes to take their children to school.

Luyuan's initial business model which heavily relied on outsourcing the component manufacturing was challenged in 1999 by a large-scale battery crisis. Over 3000 batteries broke down just within 3 months (the life expectancy is normally 2~3 years), and customers were furious. When Luyuan informed the battery supplier about the quality problem, the supplier refused to take responsibility to solve the problem and rejected all the returns. Facing double attacks from both customers and suppliers, Luyuan was on the brink of bankruptcy. Ni Jie, the founder and the Chairman of Luyuan realized that it was vital to advance the key technologies and secure the supply of the battery. He recalled all the problematic E-bikes and actively responded to the litigation raised by the supplier. He also published many articles in a well regarded journal in China known as *Battery*. He devoted much time to presenting his papers in annual meetings of battery associations, inviting firms specialized in batteries to participate in electric bike industry. These actions helped to eliminate the possibility of future battery crises. Moreover, he initiated the setting up of the national standard for E-bike batteries which took into effect in 2001.

Luyuan also took part in specifying the National Standards of General Technical Requirements of Electric Bicycles (National Standard GB1776 -1999), which was formally launched in 1999. Accordingly, when R&D efforts resulted in key technology advancements which significantly improved the E-bike performance, Luyuan was among the first to embrace them. When SARS broke out in China in 2003 and many people tried to avoid public transportation, Luyuan's business took off and the whole E-bike industry expanded exponentially in China. In 2008, Luyuan set up its own battery company called Green Power, and in 2009, Luyuan launched a new production base in Shandong, expanding the annual production capacity up to 1 million E-bikes. Luyuan continued to

lead the industry, not only by means of its R&D capabilities but also through its lean production, nation-wide exclusive distribution system, and reliable after-sales service.

4.5 Tata Swach

The idea of Tata Swach came from a research result dated back in the 1980s, which showed that the rice husk ashes (RHA) could remove visible particles in water. In 2005 this idea was used in Sujaal water purifier -- one of Tata's corporate social risk projects during the tsunami rescue. In 2009, Ratan Tata (Tata's chairman) decided to make a water purifier at the price of Rs1000. At that time only less than 5% of urban Indian families and 1% of rural Indian families used water purifiers as the available products priced above Rs2000 were not affordable. Tata's vision for Swach was a mobile compact product, running without electricity or running water, without harmful chemicals in the long run, eliminating water-borne diseases and its performance should meet the international standard.

Tata Sujaal's unique RHA is a natural low-cost and durable substitute for the prevalent water purification material (i.e. carbon or silica). But RHA could not remove micro-organism in the water to meet the international standard. Silver in India is known as a micro-biocide, but regular use of silver is costly and not good for health. Hence the scientists in Tata Chemical "nanoed" silver by using their existing technologies. Combining RHA with nano-silver, the purification finally met the standard. As their target customers were people who only store water for some time to let the dusk sink before use, the original idea was to sell the purification bulb itself and let people use it in their own water container. But after a six-month market test, they found that people

expected a holistic “high-tech” product (water purifier) instead of the bulb. Hence they found a low cost substitute for the plastics needed to make the containers.

In 2009, when Tata Swach launched its water at the price of Rs899, there was no competition at all. Since then, many competitors entered this segment. But thanks to its patented RHA and nano-silver technologies, Tata Swach remains the market leader.

4.6 ARM

When Acorn Computers, based in Cambridge UK, needed 16 or 32 bit microprocessors for their PC products, they were dissatisfied with those available on the market. They found that the Berkeley Reduced Instruction Set Computing (RISC) chip design could bypass many problems involved in standard chip design. They decided to “have a go at building such a microprocessor” (The Guardian, 08/03/2001). The only way they could do this with the limited resources at their disposal was by keeping it very simple. The Acorn RISC Machine (ARM) CPU was of very small size, designed with few transistors and extremely low power consumption. These attributes turned out to be of great value in the emerging mobile device market (Sapsed, 1999).

In 1985, a joint venture, ARM, was formed between Apple Computers and Acorn. Initially this was to develop a microprocessor for Apple Computer’s Newton Notepad. When the Newton Notepad failed to gain market acceptance, the business model adopted for the new venture was significantly changed to designing a base technology and then licensing the intellectual property (ARM Annual Report, 2005). Robin Saxby had been recruited as ARM’s first CEO from Motorola, where he had acquired extensive marketing expertise. This was combined with the advanced technical skills of the 12

engineers who moved to ARM from Acorn's Advanced R&D department. Saxby proved to be a charismatic leader, who encouraged his engineers to develop skills in sales and customer support.

Microprocessors which offered small size, lower cost and lower power consumption did not provide performance factors of interest in the PC sector. For this reason Intel, for example, did not pursue this market. But ARM recognised that there were new customers who needed these performance factors in the emerging mobile device sectors. Not only did ARM identify this opportunity, they developed a new business model that created a new range of opportunities. While they had initially sub-contracted production of their chip design to VSLI, they chose to change direction and began to offer design and customer support services to customers in a wide range of sectors (Presentation by Robin Saxby 2008). When a then relatively unknown Finnish company, Nokia was seeking a CPU design for its mobile phone that would work reliably in the background, use minimum power, and be well supported with design tools, models and applications, ARM could readily meet its requirement. Building on this experience, ARM's processor was developed as a programmable tool for other customers developing Complex Systems on Chips.ARM could offer customers the capability to customize their designs for low power-consumption chips for highly integrated applications such as cell phones, personal digital assistants, information appliances and other embedded systems. This process was supported by the development of a distinctive IP centred business model. This strategy enabled chips designed by ARM to quickly become the de facto global standard in embedded devices, and it has remained so to this day in high volume applications in the wireless, consumer electronics and networking markets.

5. RESULTS

The overall results are presented in Table 3 and Table 4. Table 3 below summarises our findings with regard to attributes of entrepreneurial behavior related to Opportunity Discovery and Table 4 summarises attributes related to Opportunity Creation. The scoring of case attributes reflects the difficulty of assigning the cases to one or other category. For each case, some of the attributes appear to conform to those assigned by Barney and Alvarez to opportunity discovery - but the cases also have attributes that fit their category of opportunity creation. Thus the first finding of this study is that both opportunity discovery and opportunity creation strategies were used and in practice the distinction proposed by Barney and Alvarez (date) does not apply clearly to these cases.

From Table 3 we see that 38 of the scores for the case studies fit the attributes assigned to opportunity discovery, as against fewer than half as many attributes that do not fit. However this was not because the cases are well formulated in terms of opportunity discovery since in Table 4 we see that 36 of the scores also fit the attributes assigned to opportunity creation. Comparing the results of each case in Table 3 and those in Table 4, we found that Suzlon and Tata Swach have more attributes of opportunity discovery than opportunity creation, while Luyuan and ARM have more attributes of opportunity creation than opportunity discovery; the remaining cases (Sony and Seagate) show rather mixed results. We selected Suzlon and ARM case to illustrate our findings in more detail.

Table 3 Opportunity discovery in DI cases

	Seagate	Sony	Suzlon	Luyuan	ARM	Tata Swach	**Total***
1. Nature of opportunities (Source of opportunities is information asymmetry)	✓	×	✓✓	×	✓✓	✓✓	4✓2×
2. Nature of entrepreneurs (Different from non-entrepreneur, ex ante)	×	✓✓	✓✓	✓✓	✓	✓✓	5✓1×
3. Nature of decision making context (Risky)	×	×	✓✓	×	×	✓✓	2✓4×
4. Leadership (Based on expertise and experience)	✓	✓	✓	✓	✓✓	✓	6✓0×
5. Decision making (Risk-based data collection tools costs)	×	×	✓	×	×	✓	2✓4×
6. HR practices (Specific human capital recruited broadly)	✓	✓✓	✓	-	✓	✓	5✓0×
7. Strategy (Relatively complete and unchanging)	✓	✓✓	✓✓	×	×	✓✓	3✓3×
8. Finance (External capital sources: banks and venture capital firms)	✓	✓	✓✓	×	×	-	3✓2×
9. Marketing (Changes in marketing mix may be how new opportunities manifest themselves)	✓	×	✓✓	×	✓	✓✓	4✓2×
10. Sustaining competitive advantage (Speed, secrecy, and erecting barriers to entry may sustain advantages)	✓✓	✓	×	✓	✓	✓✓	5✓1×
Total*	7✓3×	6✓4×	9✓1×	3✓6×	6✓4×	9✓0×	38✓20×

* The total number of ✓ here only count the "✓✓" as one instead of two.

Table 4 Opportunity creation in DI cases

	Seagate	Sony	Suzlon	Luyuan	ARM	Tata Swach	**Total***
1. Nature of opportunities (Source of opportunities is exogenous shocks)	×	✓✓	×	✓✓	✓	×	3✓3×
2. Nature of entrepreneurs (Different from non-entrepreneur, ex post)	✓	×	×	×	✓✓	×	2✓4×
3. Nature of decision making context (Uncertain)	✓	✓✓	×	✓✓	✓✓	×	4✓2×
4. Leadership (Based on charisma)	-	✓	✓	✓	✓	✓	5✓0×
5. Decision making (Iterative, inductive, incremental decision making; use of biases and heuristics; importance of affordable loss)	✓	✓	×	✓	✓✓	×	4✓2×
6. HR practices (General and flexible human capital recruited from pre-existing social networks)	×	✓	✓	-	✓	×	3✓2×
7. Strategy (Emergent and changing)	✓	×	×	✓✓	✓✓	✓	4✓2×
8. Finance ("Bootstrapping" and "friends, family and fools")	×	×	×	✓	-	-	1✓3×
9. Marketing (Marketing mix may fundamentally change as a result of new opportunities that emerge)	✓	✓✓	×	✓✓	✓	×	4✓2×
10. Sustaining competitive advantage (Tacit learning in path dependent process may sustain advantages)	✓	✓✓	✓✓	✓✓	✓✓	✓✓	6✓0×
Total*	6✓3×	7✓3×	3✓7×	8✓1×	9✓0×	3✓6×	36✓20×

* The total number of ✓ here only count the "✓✓" as one instead of two.

In the case of Suzlon, the nature of the opportunity, the nature of the entrepreneur, and the nature of the decision making context appear to fit the opportunity discovery category. There was a clear market failure in the inadequacy of provision of conventional energy services in India at that time. In turning to wind energy Tanti was recognizing that the intermittency seen as a drawback to wind energy could not be worse than the power failures of the electric grid. He developed a clear vision for Suzlon – to supply and bring down the cost of power in India which was for him an entrepreneurial project from the start, and therefore denotes an *ex ante* entrepreneurial orientation. The decision making context for the move from textile to wind turbine business was fraught with risk because Hence Tanti decided to adopt an "end-to-end solution" and vertically integrated the entire value chain from site location research to grid installation. Although Tanti had to leverage his own social network to draw in the first customer, potential market demand was predictable and the Indian government offered supportive schemes for renewable energy businesses. Tanti's decision to enter into wind turbine business was based on well researched information and calculation of the risks which enabled him to know the required skill set and to hire specialist from Europe, another attribute of discovery. His vision and strategy were relatively complete and unchanging from the beginning – that is to use an acquisition strategy to integrate both the upstream and downstream businesses into one Suzlon kingdom. Suzlon's clear vision, business model, strategies helped it obtain external finance and achieve a successful IPO in 2005 (Vietor & Seminerio, 2008). Suzlon's wind turbines, prices, value network, marketing and maintenance services constituted a unique package that met market demand in India and many other countries.

The case of Suzlon case fits the attributes assigned to opportunity discovery in 9 respects, but not as regards how they sustain their competitive advantage. What distinguish Suzlon from the others are low prices, rapid installation, cheap and reliable maintenance, most of which are based on tacit learning achieved with its international customers over time. The leadership style at Suzlon was partly based on expertise and experience (though not of the new activity) but also partly charismatic. There were important technical achievements in Suzlon's turbines and extensive experience of turbine installation in various countries, according to the head of commissioning and global operations. At the same time, Tulsi Tanti's leadership was charismatic in that he articulated a clear vision, understood how to sustain Suzlon's competitive advantages and had insight into the future of the industry. Finally, Suzlon relied not only on specialist expertise from Germany, but also on general and flexible human capital recruited from pre-existing social networks including the engineers from Tanti's textile factories. In brief, we are not dealing with a clear cut case of opportunity discovery as summarized in Table 3, but nor does the case fit all the attributes of opportunity creation summarized in Table 4.

For disruptive innovations that show strong attributes of opportunity creation, we turn to the case of ARM, which featured 9 attributes associated with opportunity creation in the taxonomy presented by Barney and Alvarez. In this case, opportunities were recognized largely as a result of special expertise in RISC chips, a technology well suited to the emerging mobile devices markets. Thus the case features information asymmetry. Their knowledge at ARM of the value of their low power RISC chip in the emerging market for embedded devices suggests a case of opportunity discovery. However in other respects we see active creation of opportunity aligned with the attributes summarized in Table 4.

The original founders became increasingly entrepreneurial as they proceeded, rather than being so *ex ante*, since they had been R&D engineers in the company from which ARM spun out. But the CEO who became a member of the founding team was from an established company (Motorola). He had the market insights and was different from non-entrepreneurs *ex ante*. Hence the entrepreneurial team of ARM was a mix of both types of entrepreneurs. Opportunities were proactively created by the shift in strategy and development of an IP model that provided customer support as well as design services. The decision-making context was highly uncertain and incalculable and the leadership charismatic; this was the context resulting in a change of strategy. While the 12 engineers who originally helped to found ARM were specialists, they became generalists in learning sales skills and the CEO Saxby was a generalist. They pursued an economical business model to reduce reliance on venture capital; ARM, like Luyuan rapidly became revenue earning. They altered their market focus in response to the opportunities they were creating on the basis of their specialist knowledge. They sustained their competitive advantage both through their special expertise and unique customer relations. In brief, although ARM case has more evidences to support an opportunity creation, it does also feature attributes of opportunity discovery as well.

We found that the most frequently used strategy for disruptive innovation cases is a leadership style based on expertise and experience and the sustaining of competitive advantage through tacit learning in a path dependent process (both scored 6 positives). Thus the entrepreneur's prior knowledge (expertise or experience) about a certain market or industry may be critical for identifying prospects for DI. Likewise, the tacit learning in the process of cultivating DI can give rise to competitive advantage. The other much used

strategies are HR practices associated with opportunity discovery (specialist human capital recruited broadly), sustaining competitive advantage by means of speed, secrecy, and erecting entry barriers, and charismatic leadership (all score 5). This is consistent with the nature of disruptive innovation; most DIs are highly uncertain initially (targeting a new customer set) and hence charismatic leaders are essential to encourage the team to persist using trial and error processes in the market. When DIs start to erode the mainstream market, conventional strategies such as speed, secrecy, and erecting entry barrier are needed to enable the entrants to survive often intense competition. The frequency of recruitment of specialist human capital reflects the way most DI cases involve technological research and development.

6. DISCUSSION

A number of possible explanations could be offered for the lack of clear cut fit of these cases to one or the other categories of opportunity recognition and creation. One explanation might be that the distinction between opportunity discovery and creation is unsound. Another is that the attributes associated with it in Tables 3 and 4 are inappropriate. The third possible explanation is that there is something distinctive about disruptive innovations and that these constitute a special and separate category in which there is overlapping opportunity discovery and creation. We now discuss each of these three explanations in detail.

6.1 Our interpretation of the findings and of prior literature is that the distinction between opportunity discovery and creation is indeed of value, both conceptually and empirically. It is undoubtedly true that in some cases markets and technologies are

already available for those with the knowledge and acumen to recognize and exploit them. In other cases entrepreneurs have to create as yet unavailable opportunities by carrying out the function of "market makers" and complementary innovations must be mobilized to enable an opportunity to be realized even for a technology ready for use, while other technologies may need extensive development work.

6.2 Since the distinction between opportunity discovery and creation is a useful one, it is necessary to consider whether the *attributes* assigned to these approaches to the pursuit of opportunity in Tables 3 and 4, are inappropriate. Barney and Alvarez derived their distinctions from specific theories of entrepreneurship and these therefore come into question. We saw in the literature review that their dichotomy is consistent with that made by Sarasvathy (2001) between allegedly classic causation theories of entrepreneurship and effectuation approaches. In the former, the entrepreneur engages in rational planning in order to achieve a pre-determined objective. In the latter, the entrepreneur has not identified a given opportunity to pursue, but is engaged in exploring possibilities that may or may not turn out to be opportunities; these have to be created by the effectuating entrepreneur (Sarasvathy, 2001).

Sarasvathy does acknowledge that causation and effectuation processes '… can occur simultaneously, overlapping and intertwining over different contexts of decisions and actions… I deliberately juxtapose them as a dichotomy to enable a clearer theoretical exposition." (Saravasy, 2001). We submit that these "overlapping and intertwining aspects" have a confounding effect on empirical analysis. They make insufficient distinction 1) between entrepreneurial and corporate innovation and 2) they fail to take into account the way entrepreneurs approach means in creative and unplanned ways as

well as altering their objectives. 3) They are unsuited to explaining cases of disruptive innovation where discovery and creation processes are combined.

6.2 The results reveal the distinctiveness of DI cases. While DI's initially inferior performance features may help entrepreneurs to escape the radar of the incumbents, they also force entrepreneurs to develop new features that appeal to low-end market or new market customers. For example, Suzlon was not considered a threat to the wind turbine incumbents initially, but to attract early customers Suzlon lowered prices and provided an integrated service. An opportunity for disruptive technological innovation may exist owing to advances in relevant technologies (e.g. for Seagate and ARM), convergence of technological advancements (e.g. Sony), and failure of previous R&D efforts or experiments (e.g. Tata Swach). Discovery here required entrepreneurs' expertise and experience. But entrepreneurs who are determined to explore the un-tapped markets, can make a pioneering move via trial-and-error processes (e.g. Suzlon, Luyuan, Tata Swach, and Sony). Disruptive innovations alter the terms of competition, make provision for new kinds of customer (as did all the cases discussed) and often challenge the market dominance of incumbent firms (as did Seagate with respect to other HDD firms and ARM with respect to Intel and other incumbent semi-conductor firms). These disruptive innovations were made possible because the entrepreneurs reconfigured their means-ends framework in terms of opportunities and the means to realize them.

7. THEORETICAL IMPLICATIONS

The evidence and review of theory presented here implies a concept of entrepreneurial innovation different from that found in recent entrepreneurship literature.

7.1 Corporate decision-making vs the 'classic' causation theory of entrepreneurship

Many of the attributes assigned to ‘classic’causation style decision making by entrepreneurs and to opportunity discovery are typical of methods viewed as best practice by and for corporate managers, as summarised by Stevenson (Stevenson & Jarillo, 1991). While rational planning can be expected to focus on securing appropriate means to achieve given ends, entrepreneurial innovators are likely to improvise means to achieve ends or alter their ends, or do both, in processes that may combine opportunity discovery and creation. The conceptualization is counter to the rational planning approach, where plans focus on securing resources as early as possible (“Investments and [preparatory] actions…typically follow the firm formation decision..”(Shah and Tripsas, 2007). The ‘classic’ or ‘causation’ theory of entrepreneurship presents a stylised form of rational planning. Thus Shah and Tripsas (2007) acknowledged that their depiction is a ‘somewhat stylized account’ that ‘appears rational and calculated with roughly linear stages.” This is an ideal type without detailed empirical foundation, but it has been attributed to entrepreneurs by a number of authors and treated on a par with accounts of entrepreneurship that are grounded in evidence (Alvarez and Barney, 2004; Fisher, 2012; Sarasvathy, 2001; Shah and Tripsas, 2007).

When entrepreneurs turn to corporate planning processes for guidance they may use conventional project planning methods. But according to theories of entrepreneurship that also have a claim to being classic, these are not typically entrepreneurial forms of decision-making (see Eckhardt and Shane (2003); Freeman (1982), Penrose (1959), Stevenson and Jarillo (1991)). It seems that the theoretical basis on which the Opportunity Discovery attributes are assigned by Barney and Alvarez in Tables 3 and 4 does not recognize that the ‘classic’ theory of entrepreneurship (Shah and Tripsas, 2007)

actually describes the decision-making process long advocated for corporate managers (Simon and March, 1958).

Corporate managers are not encouraged to alter the prevailing means-ends framework of their company (Stevenson and Jarillo, 1990). Instead they start with an identified opportunity (often selected through a formal discovery process) and plan to realize the opportunity using endorsed means, securing the necessary budget allocation and the human resources to make this possible. To take a particular effect as given and focus on "selecting between means to create that effect." (Saranavasy, 2001) which has been described as classic entrepreneurial behaviour is actually a description of how corporate managers proceed once a goal has been approved by their hierarchy and they are seeking the most effective way of reaching it. When these methods are used in startups, for whatever reason, these are diverging from typically entrepreneurial innovation processes.

7.2 Means and ends – the entrepreneurial calculus

The entrepreneurs we studied re-ran their means-ends calculus according to the availability of resources and changing circumstances; creative use of means altered the chances of realizing opportunities. The evidence from the cases presented here shows that innovation results when entrepreneurs recognise the potential for both resources and opportunities to be pursued in new ways to create and capture value (Garnsey, 1998). This was recognised by classic authors on entrepreneurship including Penrose (1960) and Freeman (1982), who wrote of innovation that results from "a matching process of new technology and new markets, guided by imaginative entrepreneurs". The continual scanning and re-assessment of means and ends, of resources, processes and opportunities, is a key feature of entrepreneurial problem solving. For example,

access by the entrepreneurs to the resources embodied in miniaturisation, wind energy technology, the e-bike, the RISC chip technology, etc., altered the means-ends possibilities for entrepreneurs and they took advantage of this to create value. They changed their means-ends calculus in response to new conditions whether they had control over a key resource or whether they had to find creative ways (means) to access resources needed to realise the opportunity.

Effectuation theory recognizes the flexible and creative mode in which entrepreneurs tend to operate. Sarasvathy is justified in emphasizing that entrepreneurs engage in effectuation by building on who they are, what they know and who they know. Undoubtedly entrepreneurs are adept at gaining leverage from their knowledge and their networks and benefit greatly from doing so. But the attempt through effectuation theory to highlight an elegant distinction between *the pursuit of given ends using optional means, and the pursuit of optional ends using given means* pre-empts a third possibility –the flexible pursuit by entrepreneurs of both ends and means. The entrepreneurs studied here did not make do with the resources at their disposal, as assumed in theories of effectuation and also of 'bricolage' (Baker and Nelson, 2005). Instead they actively sought to extend and add to these personal and relational resources in pursuit of entrepreneurial objectives. This is consistent with theories of entrepreneurship that pre-date recent contributions. Entrepreneurs set out without the knowledge or resources they needed to realize an opportunity, as predicted by Stevenson (2006).

For example, ARM targetted the mobile device market while lacking marketing resources of a conventional kind. To get past this deficit they provided design and customer support services for key alliance partners who sold the end product into mobile device markets,

enabling ARM to gain royalties and licensing revenues from markets without undertaking conventional marketing expenditure. Suzlon aimed to move into the wind energy sector without any of the knowledge required to be successful in this sector, but succeeded in allying with a German firm that could provide this knowledge, later buying this firm. Luyuan did not start out with the relational resources (networks) enabling them to influence government safety standards for e-bikes, but they deliberately cultivated and developed these network resources.

In several of the case studies, goals or ends were reconfigured as the entrepreneurs proceeded. The pressures of necessity encouraged their inventiveness. Thus Suzlon started by seeking a reliable energy source for a textile business and moved their strategic goal to providing a new form of energy; ARM intended to subcontract the production of their RISC chips and instead developed an IP business model involving no sub-contracting. Luyuan started in E-bike business and went on to diversify into the battery business for E-vehicles.

Entrepreneurs can only act before they have control over resources because they reconfigure both means and ends to find new ways to innovate. “entrepreneurial decisions are creative decisions. That is, the entrepreneur creates the means, the ends or both. (Eckhardt and Shane, 2003)”. In other words, for creative entrepreneurs means are not given (the resources at their disposal in bricolage), but, like ends, can be reconfigured in an interactive and iterative process of problem solving.

Our evidence also qualifies the theory of entrepreneurial means and ends framework as presented in economic theory. “The creation of new means-ends frameworks in entrepreneurial decision making is a crucial part of the difference between entrepreneurial

opportunities and situations in which profit can be generated by optimizing within previously established means-ends frameworks..” (Eckhardt and Shane, 2003). Economists who have addressed the role of entrepreneurs in the economy have focused on their recognition of deficient price signals and the improved resource allocation which results from their putting resources to better use in this way (Casson, 1982). But our case studies show that the flexible means-ends calculus of the entrepreneur goes well beyond the reallocation of resources to a fixed set of goods and services through a creative response to pricing possibilities, as assumed by these economists. Instead entrepreneurs are adept at creating new means (new resources), as when they develop new technologies which become means to the realization of new strategic goals or opportunities. Resource creation of this kind (creating new means) is demonstrated by Seagate, Sony, Suzlon, Luyuan and ARM. Entrepreneurs are also adept at gaining leverage from such resources as are at their disposal, especially (as Sarasvathy correctly points out), from their knowledge and networks. They are adept at economizing on resources and at enlisting others to make available further resources in return for a share in the returns from new value creation (Hugo and Garnsey, 2004).

7.3 Disruptive Innovations – Opportunity Recognition and Creation

The process by which disruptive innovations have taken place have represented *par excellence* cases of the reconfiguration of means and ends where entrepreneurs are taking decisions in conditions of uncertainty, with indefinite goals and limited resources. The entrepreneurs’ prior knowledge or experience about a given market or industry may be critical to recognising the opportunity for a disruptive technology, but at the same time strong elements of opportunity creation are required. The strategy is emergent, involving

market exploration as the entrepreneurs find out more about relevant business ecosystems. They come to recognize that they could meet the demands of a new set of customers without some of the product features expected by existing customers. They attempt by trial and error to bring down costs and improve performance on a range of product features.

DI cases tend initially to be highly uncertain and charismatic leaders are needed at the head of entrepreneurial teams to pursue the opportunity via trial and error processes and to create the appropriate marketing mix (product, price, distribution channel, promotion and after sales services, etc). Such processes then yield tacit knowledge which can help sustain the competitive advantage of the company.

In defense of the rational planning method associated with causation theories of entrepreneurship (Fisher, 2012; Sarasvathy, 2001), it should be recognized that while creative approaches to entrepreneurship are what enable a minority of firms to succeed, their 'hit or miss' nature is not without wasteful features. New businesses using such methods have very high rates of attrition. Venture capitalists who insist on conformity to rational planning milestones run the risk of preventing entrepreneurs from being responsive to unpredictable developments. The flexibility to change direction is greater for entrepreneurial than that for corporate innovators and has been demonstrated by many successful ventures. But Venture Capitalists may have good reasons to encourage the ventures in which they invest to select goals and identify feasible means to reach them by identifying promising markets and robust technologies. This systematic approach could be applied to the pursuit of purposive disruptive innovation. Once they have clearly identified unmet needs in a market with customers who require simpler, lower cost solutions to a widespread problem, entrepreneurs could set out to devise such solutions and construct a

disruptive innovation. In doing so they could learn both from orthodox corporate strategic process *and* from the improvisation approaches used by entrepreneurs, as described in our case studies.

Discovery and Creation are not the inverse of each other but are orthogonal, and could be used in combination to realise Creation-Discovery opportunities. We have illustrated the differences between these three categories using examples from developed markets (supercomputer and transistor), new examples from emerging markets (a renewable energy supplier and an e-bike supplier) together with an example of a case that disrupted the established semiconductor market.

Emerging markets will continue to offer many technological disruptive innovation opportunities to entrepreneurial firms because there is high aggregate demand for good-enough products/services which are also affordable to the customers in the bottom of the pyramid (Prahalad & Lieberthal, 1998). Many MNCs have started to pay attention as the growth potential of emerging markets could not only compensate for the persistent slowdown in advanced markets, but are also likely to create reverse innovation candidates to stimulate new markets in the near future (Immelt, et al., 2009).

REFERENCES

Alvarez S., Barney J., 2004. Organizing rent generation and appropriation: toward a theory of the entrepreneurial firm. Journal of Business Venturing 19, 621–635.

Alveraz, S.A., J.B. Barney, 2007. Discovery and creation: alternative theories of entrepreneurial action. Strategic Entrepreneurship Journal Vol 1, Issue 1-2, 11–26.

Baker, T., Nelson, R.E., 2005. Creating something from nothing: Resource construction through entrepreneurial bricolage. Administrative Science Quarterly, 50, 329-366.

Busenitz, L.W., Barney, J.B., 1997. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. Journal of Business Venturing, 12: 9-30.

Casson, M. 1982. The Entrepreneur, an Economic Theory. Aldershot, Gregg Revivals.

Christensen, C.M., 1997. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business School Press, Boston.

Christensen, C.M., 2006. The ongoing process of building a theory of disruption. Journal of Product Innovation Management 23, 39-55.

Christensen, C.M.; Raynor, M., 2003. The Innovator's Solution. Harvard Business School Press, Boston.

Dutta, E.K. and Crossan, M.M., 2005. The nature of entrepreneurial opportunities: Understanding the process using the 4I organizational learning framework. Entrepreneurship Theory and Practice 29(4), 425–449.

Eckhardt, J.T. and Shane, S.A., 2003. Opportunities and entrepreneurship. Journal of Management 29(3), 333–349.

Fisher, G., 2012. Effectuation, causation, and bricolage: A behavioral comparison of emerging theories in entrepreneurship research. Entrepreneurship Theory and Practice, 36(5), 1019–1051.

Freeman, C. 1982. The Economics of Industrial Innovation. Pinter, London.

Gaglio, C.M., Katz, J.A., 2001. The psychological basis of opportunity identification: Entrepreneurial alertness. Journal of Small Business Economics 16(2), 95–111.

Gartner, W.B., 1985. A framework for describing and classifying the phenomenon of new venture creation. Academy of Management Review 10(4), 696–706.

Gartner, W.B., Carter, N.M., G.E. Hills, 2003. The language of opportunity, in Steyaert C., Hjorth D. (Eds.), New Movements in Entrepreneurship. Cheltenham, Edward Elgar, UK, pp.103–124.

Hugo, O., Garnsey, E., 2004. Problem-solving and competence creation in the early development of new firms. Managerial and Decision Economics 26(2), 139–148.

Immelt, J.R., Govindarajan, V, Trimble, C., 2009. How GE Is Disrupting Itself. Harvard Business Review 87 (10), 56-65.

Kaisch, S., Gilad, B., 1991. Characteristics of opportunities search of entrepreneurs versus executives: Sources, interest, and general alertness. Journal of Business Venturing 6(1), 45–61.

Kirzner, I. M., 1973. Competition and Entrepeneurship. University of Chicago Press, Chicago and London.

Langley, A., 1999. Strategies for theorizing from process data. The Academy of Management Review 24(4), 691-710.

Kirzner, I.M., 1979. Perception, Opportunity and Profit. University of Chicago Press, Chicago.

Kostoff, R. N., Boylan, R., Simons, G. R., 2004. Disruptive technology roadmaps. Technological Forecasting Social Change 71(1) 141–159.

Lindsay, J, Hopkins, M., 2010. From experience: Disruptive innovation and the need for disruptive intellectual asset strategy. Journal of Product Innovation Management

27(2), 283-290.

Linton, J.D., 2004. Determining demand, supply and pricing for emerging markets based on disruptive process technologies. Technological Forecasting and Social Change 71, 105-120.

Locke, E.A., Baum, J.R., 2007. Entrepreneurial motivation. in Baum, J.R., Frese, M., Baron, R.A., (Eds.), The Psychology of Entrepreneurship. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 93-112.

Morita, A., Reingold, E. Shimomura, M. 1987. Made in Japan, EP Dutton.

Penrose, E., 1959. The Theory of the Growth of the Firm (1995 Edition). Oxford University Press, Oxford.

Penrose, E. 1960. The growth of the firm – a case study: The Hercules Powder Company. Business History Review 34(1), 1-23.

Prahalad, C.K., Lieberthal, K., 1998. The End of Corporate Imperialism. Harvard Business Review 7-8, 69–79.

Rauch, A., Frese, M., 2007. Born to be an entrepreneur? Revisiting the personality approach to entrepreneurship, in Baum, J.R., Frese, M., Baron, R.A., (Eds.), The Psychology of Entrepreneurship. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 41 -65.

Sarasvathy, S.D., 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. Academy of Management Review 26(2), 243–288.

Sapsed, 1999. Restricted Vision: Strategizing under Uncertainty. Unpublished D.Phil. thesis. University of Sussex.

Schumpeter, J., 1934. Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle. Harvard University Press, Cambridge, MA.

Shah, S.K., Tripsas, M., 2007. The accidental entrepreneur: The emergent and collective process of user entrepreneurship. Strategic Entrepreneurship Journal, 1, 123–140.

Shane, S., 2000. Prior knowledge and the discovery of entrepreneurial opportunities. Organization Science 11(4), 448-469.

Shane, S., Locke, E.A., Collins, C.J., 2003. Entrepreneurial motivation. Human Resource Management Review 13, 257-279.

Shane, S., Venkataraman, S., 2000. The promise of entrepreneurship as a field of research. Academy of Management Review 25(1), 171-184.

Shane, S., 2003. A General Theory of Entrepreneurship: The individual-opportunity Nexus. Edward Elgar: Northampton, MA.

March, J.G., Simon, H.A., 1958. Organizations. Wiley, New York.

Stevenson, H.H., 2006. A perspective on entrepreneurship. Harvard Business School Case 9-384-131. Harvard Business School Publishing, Boston, MA.

Stevenson, H., Jarillo J., 1990. A Paradigm of Entrepreneurship: Entrepreneurial Management. Strategic Management Journal 11, 17-27

Tellis, G. J., 2006. Disruptive technology or visionary leadership? Journal of Product Innovation Management 23(1): 34–38.

Utterback, J.M., Acee, H.J., 2005. Disruptive technologies: An expanded view. International Journal of Innovation Management 9(1), 1-17.

Vietor, R.H.K., Seminerio, J., 2008. The Suzlon Edge. Harvard Business School case 9-708-051. Harvard Business School Publishing, Boston, MA.

Weick, K.E.,1979. The Social Psychology of Organizing. McGraw-Hill, New York.

Yu, D., Hang, C.C., 2010, A reflective review of disruptive innovation theory, International Journal of Management 12, 435-452.