THE OPPORTUNITY RECOGNITION PROCESS - THE MECHANISMS BY WHICH ENTREPRENEURIAL OPPORTUNITIES ARE RECOGNISED AND THE ROLE PLAYED BY SOCIAL NETWORKS IN THIS PROCESS

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Thesis Summary

This research study is based upon the premise that in order for entrepreneurial opportunity to be exploited it must first be recognised. An exploration of the theory regarding entrepreneurial opportunity has uncovered two main strands of thought regarding the process of opportunity recognition. These have been termed *deliberate search* and *entrepreneurial alertness.*

Deliberate search is based upon the theory of Drucker (1985) who proposes that in order for entrepreneurial opportunity to be recognised, the entrepreneur must conduct a deliberate and systematic search into particular areas in their business and social environment. 'Entrepreneurial alertness' is a phrase coined by Kirzner (1979) who explains opportunity recognition in terms of cognition and heuristics. Theory surrounding this notion of entrepreneurial alertness examines the role played by cognition with regards to the entrepreneur's ability coordinate knowledge in a way that allows them to establish novel linkages and perceive new means-end relationships.

Through the examination of 49 retrospective case studies, the opportunity recognition process is analysed with respect to these mechanisms and the common characteristics, behaviours and processes that are apparent in the successful recognition of an opportunity. Further to this is an examination of the role played by the creation and maintenance of social networks in facilitating this process. Entrepreneurship theory highlights the effectiveness of networking in supplementing resources and gaining access to knowledge, information and skills. This study looks at networks in terms of their ability to supplement the process of opportunity recognition.

The case study analysis highlights the effectiveness of these mechanisms in the opportunity recognition process and the role played by networks. From this analysis a framework is devised highlighting the complementarity between the two mechanisms and an explanation is offered as to how these two mechanisms are both reliant upon the cognitive, behavioural and knowledge differences highlighted in the discussion.

Keywords: Innovation, Entrepreneurship, Deliberate Search, Entrepreneurial Alertness, Knowledge

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Chapter 1 – Introduction and Outline

1.1 Introduction

In order for companies or individuals to ensure long-term business success, it has been argued that the recognition of new business opportunities is of paramount importance (Trott, 1998; Robert, 1993). This research study examines entrepreneurial opportunity in terms of the mechanisms by which opportunities are recognised and the role that is played by social networks in facilitating this process.

Although a great deal of literature currently exists surrounding the processes and dynamics of *exploiting* innovative opportunity, there is relatively little research that uncovers the types of activities that companies or individual entrepreneurs undertake in order to *recognise* these opportunities (Trott, 1998; Christensen, Madsen and Peterson, 1994; Ucbasaran, Westhead and Wright, 2000).

This study follows the assumption made by Shane and Venkataraman (2000) who claim that although opportunities may exist, they are only of benefit to the business or entrepreneur who can actually *recognise* their existence. Within this body of theory, there is little conclusive research that examines the types of activities, behaviours and skills that are required by entrepreneurs and firms who aim to recognise exploitable opportunity.

Therefore, the focus of this research is upon opportunity in terms of *recognition*. The research aim is to contribute to theory on entrepreneurial opportunity. This is achieved by examining at the gap in the literature between the understanding that opportunities *exist* and the analysis of the *exploitation* of such opportunities. A comprehension and awareness of how entrepreneurs *identify* or *recognise* exploitable opportunity is built by examining the mechanisms used and behaviours exhibited by entrepreneurs in the opportunity recognition process.

In reviewing the literature in this field it is apparent that there are two main mechanisms by which opportunities may be recognised. For the purposes of this study, these have been termed: *deliberate search* and *entrepreneurial alertness*.

In regards to *deliberate* search, it has been suggested that entrepreneurs who are wishing to seek new entrepreneurial opportunities can search deliberately and systematically in specific areas using a technique known as monitoring and scanning (du Preez and Pistorius, 1999). Specific areas that are highlighted often include market/industry structures, company and product performance and rival companies and products, with *change* often being cited as a catalyst for such opportunities.

Alongside this notion is the concept of 'entrepreneurial alertness' (Kirzner, 1979). This is the belief that entrepreneurs are individuals who possess particular skills and cognitive processes that allow them to perceive opportunity when exposed to certain stimuli or information whereas others would not. The argument is that entrepreneurs are greatly assisted when they possess the cognitive skills that enable them to combine several sources of information and process them in a way that enables an opportunity to be recognised.

Further to the exploration of these two mechanisms is an analysis of the role that is played by social networks in facilitating the process of opportunity recognition. Prior research suggests that by establishing networks of relationships, entrepreneurs can gain access to valuable knowledge, information, skills and resources that can facilitate the identification of new opportunities (Floyd and Wooldridge, 1999; Christensen, Madsen and Peterson, 1994; Low and Macmillan, 1988; Minguzzi and Passaro, 2000). This analysis examines the types of network that were the most beneficial, and the types of characteristics and linkages that were involved in these networks.

Through the examination of 49 retrospective case studies, the research examines the ways in which entrepreneurs have identified/recognised new opportunities that have led to the creation of a new firm. The analysis investigates the circumstances in which these mechanisms (deliberate search and entrepreneurial alertness) influenced the recognition of entrepreneurial opportunity, and the common characteristics that were apparent in terms of both the entrepreneur and the environment in which they were situated.

The research aim is to contribute to the theory of entrepreneurial opportunity by pulling together and augmenting these separate areas of research. This will be achieved by looking more specifically at the ways in which opportunity is recognised, the common characteristics that are apparent in the cases and the lessons that can be drawn from examining such cases.

From this a framework is devised displaying the relationship between these two mechanisms and the effectiveness of social networks in the opportunity recognition process.

1.2 Opportunity

'Opportunity' in the context of this research is concerned with the ways in which entrepreneurs have the prospect or opening to create new business or improve upon existing products or business structures, systems or services. The opportunities that are examined in this research study are concerned specifically with those opportunities that have led directly to the creation of a new venture or business start-up. The rationale for investigating only those opportunities that have led to the start-up of a new venture is that the focus of this study is that of *entrepreneurial opportunity.* The study examines the mechanisms by which entrepreneurs identify new opportunity as opposed to established firms or those firms with significant resources.

This research study follows the definitions that propose opportunity to be a 'desirable future state that is different from the current state and that is deemed feasible to achieve' (Christensen, Madsen and Peterson, 1994), or the chance to 'do things differently from and better than how they are being done at the moment' (Wickham, 2000). This can refer to new products, new processes, new technologies, incremental product improvements, new service offerings, new value creation, in fact any opportunity from which the entrepreneur is able to create a new venture.

Opportunity is often discussed in terms of exploitation and the ways in which firms can *benefit* from new opportunities (Mang, 1997; Tyre and Orlikowski, 1993). In terms of this study, the assumption is made that opportunities do not exist until they have been recognised (Shane and Venkataraman, 2000).

Venkataraman (1997) has proposed three areas of difference that exist between individuals, which may offer an understanding as to why some individuals recognise opportunity and why others do not:

- Cognitive differences;
- Behavioural differences, and
- Knowledge and information differences.

This would signify the importance of both entrepreneurial alertness and deliberate search in the opportunity recognition process, as well as the potential role that is played by establishing and maintaining entrepreneurial networks. This research study examines the role played by both of these mechanisms with the understanding that *cognitive differences* refer to the ways in which entrepreneurs accumulate and assimilate knowledge and *behavioural differences* refer to the different behaviour patters exhibited by the entrepreneurs in the opportunity recognition process.

The concept of *knowledge and information differences* notes the importance of gaining diverse and unique knowledge as recognised by Cohen and Levinthal (1990), Kaish and Gilard (1987), Trott (1998) and Wickham (2000). This research proposes that opportunity recognition, through either channel, is contingent upon the accumulation of diverse knowledge and information. This is due to the belief that the accumulation of knowledge supplements the recognition of opportunity by allowing for a more informed deliberate search and by augmenting the entrepreneur's level of knowledge in a way that increases the likelihood of entrepreneurial opportunity being identified.

Therefore, this study examines opportunity with regards to the ways in which it is *recognised* - by deliberate search, entrepreneurial alertness, or through a combination of both of these sources. This examination will be supplemented by identifying the ways in which the creation and maintenance of social networks facilitate opportunity recognition through these mechanisms.

Chapter 2 - The Opportunity Recognition Process

2.1 Deliberate Search

Opportunity recognition has been more traditionally seen as the output of a systematic and deliberate search, with the notion that opportunity for business profit can be successfully searched for and found in specific areas. As early as Schumpeter (1934) and classic economic theory, opportunity has been associated with the search of different areas in the business and social environment such as new products, new markets and new market structures.

Furthering this perspective Drucker (1985) proposes that opportunity, if searched for systematically and deliberately, can be located in seven specific areas. He argues that innovation is a tool that is used by entrepreneurs in order to exploit change as an opportunity. He dismisses outright that entrepreneurship is an innate personality trait arguing that, 'everyone who can face up to decision-making can learn to be an entrepreneur and to behave entrepreneurially.' He proposes that 'entrepreneurship, then, is behaviour rather than a personality trait'. He is one of a number of theorists who see entrepreneurial opportunity as something that can be deliberately and systematically located in certain specific areas.

He outlines seven areas that entrepreneurs should monitor in order to find new opportunity for innovation:

- *The Unexpected* – can refer to an *unexpected success, unexpected failure* or an *unexpected outside event.* According to Drucker, an unexpected success offers the richest area for innovation and the opportunities that arise from this are often less risky and arduous to pursue than others. However, these opportunities often go by unnoticed in firms due to organisational inertia. Unexpected failures, on the other hand, rarely go unnoticed, yet if the entrepreneur can engage the unexpected and understand why it is a success or a failure then it is likely that there are opportunities that could be identified through this. Unexpected outside events can also lead to the identification of entrepreneurial opportunity. However, the recognition of such opportunities requires more than 'mere luck or intuition'. The entrepreneur will only recognise such opportunities if they are actively searching for them.

- *Incongruities* – Drucker describes this as 'a discrepancy, (or) a dissonance, between what is and what ought to be, or between what is and what everybody assumes it to be... an incongruity is a symptom of an opportunity to innovate.' He divides this into four types of incongruity – incongruous economic realities, an incongruity between reality and the assumptions about it, an incongruity between perceived and customer values and an incongruity within the rhythm or logic of a process. If there is an incongruity between what is and what ought to (or should) be, then there will be opportunities to rectify this situation.
- *Process Need* – this exists within the process of a business, industry or service and is task rather than situation focused. Drucker states that 'it perfects a process that already exists, replaces a link that is weak, redesigns an existing process...supplying the missing link'. With this type of opportunity, there is often an awareness of the need, yet solutions are rarely provided. However, as soon as the innovation emerges it is immediately accepted as obvious and soon becomes standard.
- *Industry and Market Structures* – when industry or market structures change, each member of the industry has to react to the new trends and structures that are formed. Drucker believes that changes in industry and market structures can offer 'exceptional opportunities'. Four particular changes that are highlighted are *rapid growth*, *industry size*, *convergence of technologies* and *the way in which business is done.*
- *Demographics* – changes in population (size, age structure, composition, employment levels, educational status, income etc) can have an impact on many customer behaviours. These shifts are highly unpredictable, however, they have long lead times which allows those entrepreneurs who search for and recognise these changes to identify the opportunities early, thus generating a certain amount of predictability, which makes the change easier to manage. Demographics, if monitored, can provide a number of low risk opportunities.
- *Changes in Perception* – According to Drucker, when a change in perception occurs, it is the meaning, not the facts that change. These changes can occur quickly and often cannot be quantified. If the entrepreneur is alert to change and responsive to it, then changes in perception can provide a wealth of opportunities. A change in perception could include the change in perception to food consumption, which was followed by a rise in the popularity of healthy alternatives/low fat products.

- *New Knowledge* - Drucker sees knowledge-based innovation as the 'superstar' of entrepreneurship. The opportunities that arise out of new knowledge are often technological/science based and are often fairly specific in terms of their application. Drucker regards these opportunities as the least frequent and as the most risky, time consuming and problematic. However, it is the innovations that arise from these opportunities that can receive the most publicity, money and status and can often lead to a sustainable competitive advantage for the firm or entrepreneur, which can yield success for many years.

Drucker describes opportunity search as being purposeful, proactive and systematic. He claims that deliberate search for opportunity involves the 'purposeful and organised search for changes and...the systematic analysis of the opportunities such changes might offer'. With an organised, regular and systematic search into these seven areas Drucker believes that the entrepreneur is likely to recognise exploitable opportunity.

Closely related to the propositions that Drucker makes are those of Robert (1993). Robert's ideas on opportunity also relate to the notion of change and are based around Drucker's 'seven sources of innovative opportunity'. Robert expands upon these seven sources to include areas such as external events, converging technologies and high growth areas.

He claims that 'innovative leaders and organisations know where to look in their environments for changes which can be converted into opportunities for new products, customers, or markets, or for ways to improve its processes.' Furthermore he explains that there is no such argument as an entrepreneur being in "the right place at the right time", and that no amount of success in revealing opportunity can be attributed to luck. Success in uncovering opportunity for profit has to be attributed to the fact that 'some individuals and organisations are constantly on the lookout for opportunity' and that this requires having the wherewithal to examine certain areas with 'diligence and regularity'.

Alongside these propositions is the suggestion that the acquisition of knowledge is also essential to the discovery of opportunity through deliberate search.

Prior knowledge can often be a starting point in the search for entrepreneurial opportunity, whether the information is actively sought or gained spontaneously in an unplanned situation (Cohen and Levinthal, 1990). Wickham (2000) has also highlighted and detailed certain areas that he believes opportunity may arise within, however, he maintains that knowledge is the most important factor in new opportunity identification. He believes that there are a great many misconceptions surrounding the notion of entrepreneurship and opportunity which fail to take into account the amount of hard work, knowledge and skills that are required by the entrepreneur in order to search for and recognise opportunity successfully.

Another method of deliberate search has been proposed by Savioz and Blum (2002), who suggest that entrepreneurs should create and monitor what they term the 'opportunity landscape' in order to recognise opportunity.

The primary objective of the opportunity landscape is to 'identify and anticipate relevant future trends and developments in the company's technological environment by constant and systematic observation of these trends'. Important to this concept is the ability to gain access to knowledge, understand, assimilate and communicate it within the firm, as these are significant factors in the deliberate search for opportunity.

The opportunity landscape is a mechanism that has the capacity to identify and anticipate future potential technological opportunities and is based upon the belief that deliberate search centred upon the acquisition and assimilation of knowledge is pivotal to the success of the company in recognising opportunity.

Tidd, Bessant and Pavitt (2001) emphasise the importance of routinely managing the innovation process in order to recognise opportunity. They claim that entrepreneurs must be proficient in learning and changing in response to new and unanticipated opportunities and that this must be constantly managed. They highlight the continuous transfer of knowledge and information across functional and divisional boundaries as being critical in the process of innovation.

From this area of research, it is possible to propose that entrepreneurs may be able to systematically monitor and scan the business environment in a number of specific areas in order to find new entrepreneurial opportunities. Much of the literature is concerned largely

with making the deliberate and methodical search a regular practice. However, a considerable amount of research also highlights the importance of knowledge, learning, networking and strategic planning/thinking as an equally important part in this process.

Christensen, Madsen and Peterson (1994) have stated that although environmental scanning techniques and deliberate methods of search do contribute significantly to this field, they do not offer a complete explanation. Their proposition is that *behavioural* explanations are as important as structural, method-based explanations. The role of entrepreneurial behaviour is of particular interest to them. Important to this consideration is that 'entrepreneurial behaviour', as is the case in much of the research in this field, is not defined by personality traits, but rather as a learned 'management behaviour'.

They also propose that opportunity recognition is contingent upon environmental change, problem solving and other firm specific factors, however they highlight the significance of knowledge, learning, networking and strategic thinking. To Christensen, Madsen and Peterson, opportunity search is not only a process of monitoring and scanning certain areas of the business environment, but also a process of learning, perception and strategy.

For the purposes of this study the types of search practice examined were those that were prevalent in the successful recognition of entrepreneurial opportunities. The analysis uncovers the types of activities the entrepreneurs undertook, the role played by knowledge acquisition and the types of opportunities that were uncovered by the search. By assessing these variables, it is possible to reveal the ways in which the mechanism of deliberate search can benefit those entrepreneurs wishing to recognise new opportunities.

2.2 Entrepreneurial Alertness

Alongside the literature that outlines how and where to *search* for opportunity, exists another set of research that examines at the role played by cognition and heuristics as a part of the opportunity identification process. Literature from this field suggests that some individuals possess certain cognitive processes that allow them to translate particular information or inputs as a source of opportunity whereas others do not. Put most simply, the question here refers to why some people recognise particular opportunities while others do not (Shane and Venkataraman, 2000).

Kirzner (1979) created the term 'entrepreneurial alertness' in an attempt to explain this phenomenon. He sees entrepreneurial alertness as the ability of the entrepreneur to recognise opportunity whereas others do not. He describes this as 'flashes of superior insight' that enable certain individuals to recognise opportunities.

Although there is much support for the research claiming that opportunities are most likely to be found if the search is conducted in certain areas of the business environment (Schumpeter, 1934; Drucker, 1985; Robert, 1993; Christensen, Madsen and Peterson, 1994; Wickham, 2000; Tidd, Bessant and Pavitt, 2001; Savioz and Blum, 2002) many theories claim that opportunity recognition is based around cognition, knowledge coordination and heuristics which lead to heterogeneous outputs (Alvarez and Busenitz, 2001).

Important to this idea is an understanding of heuristics and the ways in which entrepreneurs can use them to identify novel linkages and recognise opportunities. Heuristics are 'simplifying strategies' that are used by entrepreneurs to make strategic decisions, especially in difficult or complex situations in which there is little information available (Busenitz and Barney, 1997). This can have a significant impact upon decision-making and thus the recognition of entrepreneurial opportunity (Wright, Hoskisson, Busenitz and Dial, 2000). Research suggests that heuristic-based logic can play a major role in the decision-making processes that allow entrepreneurs to exploit 'brief windows of opportunity' (Alvarez and Busenitz, 2001) and, therefore, it is possible to see how entrepreneurial alertness can positively impact the opportunity recognition process.

The proposition here is that the manner in which individuals identify opportunities and collect relevant data is dependent upon the different dimensions of the entrepreneur's human capital. This, in turn is dependent upon the individual's cognitive behaviours (Shane and Venkataraman, 1997; Ucbasaran, Westhead and Wright, 2000). Woo, Folta and Cooper (1992), maintain that the process of opportunity recognition is likely to be bounded by the entrepreneur's cognitive processes such as an ability to gather necessary amounts of information and the mechanisms used to assimilate it.

Shane and Venkataraman (1997) discuss the recognition of opportunity with regards to the individual's ability to recognise new *means-end relationships*. They propose that even if an individual possesses all of the relevant information that is required to recognise the opportunity, they may fail to do so because of a failure to see a new means-end relationship. Prior research has shown that people differ in their ability to identify these relationships and that people can also vary in their ability to link together previous information with new concepts and ideas.

The researchers also claim that individuals possess varying 'stocks' of information which have a bearing on whether they recognise potential opportunity. These 'stocks' of information lead to the creation of 'schemas', which create a framework for opportunity recognition. Following the research of Kaish and Gilard (1987), Shane and Venkataraman (1997) claim that:

> *'To recognise an opportunity, an entrepreneur has to have prior information that is complementary with the new information, which triggers an entrepreneurial conjecture'.*

The researchers argue that due to the specialisation of skills no two people share all of the same information at the same time, and this accounts for why the information that is required to recognise a particular opportunity is not widely distributed among the population.

This notion that outlines opportunity recognition as being a process of coupling prior related knowledge with new knowledge is, in some part, related to the ideas surrounding the recognition of opportunity through deliberate search. This ability to relate and connect knowledge sources is also explored by Cohen and Levinthal (1990). Their research suggests that prior knowledge confers an ability to recognise and develop new information. They

propose that *learning* and the accumulation of knowledge is vital to the firm's ability to recognise opportunity and that the ability to relate prior knowledge with new knowledge is a major source of innovation in that it allows for novel linkages to be made.

Cohen and Levinthal also propose that diversity of knowledge is consequential in that it strengthens innovative performance by allowing novel associations and linkages to be made. This new and diverse knowledge increases the chances of opportunity identification when linked with the related knowledge already accumulated by the entrepreneur.

This research study proposes that the recognition of opportunity by means of entrepreneurial alertness relates to the entrepreneur's ability to recognise new means-end relationships. This is closely linked to the concept that opportunity can be identified when a novel connection is made between prior related knowledge and new knowledge or information. Clearly important to this concept is the research of Shane and Venkataraman (1997), Cohen and Levinthal, (1990) and Trott (1998) who state that the accumulation of knowledge is fundamental to the process of opportunity identification.

Through the exploration of how entrepreneurs have successfully recognised opportunity by means of entrepreneurial alertness, it is possible to draw lessons as to the processes that have led to the identification of an opportunity. This proposes that it may not simply be the case that some individuals possess the cognitive skills to recognise opportunity and others do not, but that individuals who involve themselves in *certain actions and behaviours* are able to improve the likelihood of successfully recognising opportunities through this mechanism.

2.3 The Role of Networks

Networks consist of a number of interconnected, dyadic relationships that are established and used by actors in order to gain access to additional skills, knowledge, information and technologies, which can assist in the opportunity recognition process.

With regards to the type of social networks that are examined for the purpose of this research, the definition as proposed by Jones and Conway (2000) offers a useful insight.

'A conceptualisation of the entrepreneurial process as a complex and pluralistic pattern of interactions, exchanges and relationships between actors participating in that process'.

The notion of using networks to gain access to knowledge, skills and resources is prominent throughout the literature in the field of entrepreneurship. It has been recognised that the creation of networks is essential to those firms who are seeking to identify, acquire and develop new technologies (Jones, Conway and Steward, 2001) and that the use of externally gained resources can open up the 'opportunity space' by making opportunities become feasible or apparent (Christensen, Madsen and Peterson, 1994). Jones and Conway (2000) propose that networks are able to fulfil a number of roles for entrepreneurs by providing 'social support, extending the strategic competences by identifying threats and opportunities, and supplementing internal resources'.

This research study suggests that creating an extensive and diverse social network promotes and assists the opportunity recognition process as through networking the entrepreneurs open themselves up to the potential for new stimuli, information and skills which can then create an increased potential for identifying opportunities as they arise. If the entrepreneur can create and maintain an effective social network, then they will consistently open themselves to new stimuli and information, and ensure that they are constantly in the correct position in which they could receive the correct knowledge and information to identify emerging opportunities.

In considering networks and the role they play in the identification of a new opportunity, it is important to examine the different network characteristics that can influence their effectiveness in the opportunity recognition process.

Strong and Weak Ties

The strength of a tie can be determined by the degree to which individuals are linked by multiple role relations such as friendship, social club member and work colleague and the extent of this degree of linkage is termed *multiplexity* (Steward and Conway, 1994). It is presumed that the greater the number of relations that link two actors, the stronger the tie.

Important to the consideration of strong and weak ties, is that of *homophily* and *heterophily*. Homophily refers to the degree to which actors share certain beliefs or attitudes and have similar values, culture, education etc. Heterophily on the other hand, refers to the degree of dissimilarity between actors.

Research suggests that while information is more frequently exchanged in homophilous relationships, the potentially more important and unique information is exchanged during heterophilous interactions (Rogers and Shoemaker, 1972).

Granovetter (1973) suggests that the ideas that pass between heterophilous actors are more likely to be unique and are therefore more likely to be useful in the innovation process. However, it is highly probable that heterophilous contact is likely to occur between actors who have at least some common attributes.

This notion that effective social networks involve a balance between similarity and dissimilarity is explored within the concept of the *strength of weak ties* (Granovetter, 1973). In this situation, the strength is informational and refers to the information exchange potential of the relationship. However *weak ties* refers to the low level of shared attributes between the actors in the network (Steward and Conway, 1994). Therefore, the heterophilous, or weak ties are important to the opportunity recognition process as they are likely to provide more diverse and unique knowledge, whereas strong ties, although provide more frequent flows of information, are more likely to lead to the least unique and useful information over time.

Direct ties and Indirect Ties

There are three facets of a firm's network structure that influence the extent to which the firm may benefit from the network. These are the number of direct ties, the number of indirect ties and the degree to which actors are linked to each other.

According to Ahuja (2000), each of these three dimensions can affect the opportunity recognition process. Direct ties have the potential to provide three substantive benefits, knowledge sharing, complementarity (the fusing of complementary skills and technologies) and scale. When firms collaborate in developing an innovative product or process (especially technological), the knowledge that results from this collaboration is made available to all

actors within the network. Therefore, each actor can potentially gain access to a greater amount of knowledge through direct ties than if they were to pursue their projects alone. Following this, collaboration brings together complementary skills from different entrepreneurs. In such a situation, the entrepreneurs can enjoy the economies of specialisation without the investment needed to achieve this through investment. Through the sharing of skills and specific competencies, individuals can augment their knowledge base and positively impact the process of opportunity identification.

Indirect ties refer to the links that are made between the entrepreneur and another actor that is connected via a direct tie. The entrepreneur often has little or no contact with the indirect tie, yet still enjoys the benefits of the relationship. Indirect ties provide access to diverse knowledge, however the 'degree of connectivity' between actors (the relationship that is formed between focal actor and the indirect tie via the direct tie) can influence both resource sharing and access to novel information (Ahuja, 2000).

Formal and Informal Ties

Both formal and informal ties are important to the establishment and maintenance of a diverse social network that is capable of assisting the entrepreneur in the opportunity recognition process.

Formal ties can exist in terms of links with academic institutes, suppliers, distributors, local businesses, scientific networks, professional networks and a variety of other actors. They are characterised by the type of relationship that is established between the two actors. Formal ties tend to be established with the intended priority being the arranged flow of information knowledge, skills and resources.

In terms of informal ties, many different types of linkage could be recognised. Steward and Conway (1994) researched into the different types of informal network that were apparent in the innovation process and have revealed five classifications: recreation, profession, scientific, user and friendship networks. In addition to this, it is also important to highlight academic networks as a further source of information and resources.

- Recreation Networks – tend to be born out of an attachment to some recreational activity. The links established through recreational activities are often the source of unexpected and diverse knowledge, skills and resources and tend to be of an informal nature.
- Profession Networks – consist of two or more individuals operating within a given profession. In general, this type of network allows the entrepreneur to gain access to fairly specific information. Links are often forged with ex-colleagues and associates from past projects.
- Scientific Networks – characterised by the shared scientific area of expertise between individuals. The nature of the skills and know-how that are possessed by members of the group tend to lead to a mutual desire to interact with the expectation of new knowledge being shared and new ideas being communicated.
- User Networks - Networks that evolve between the entrepreneur and the potential or current users of a product or technology can often provide valuable information in regards to the recognition of an opportunity. Users are useful in that they are not often connected to the project and can thus provide impartial and equitable insights.
- Friendship Networks – predominantly informal and born out of a variety of sources. Often provides the entrepreneur with ideas and knowledge and are often the initial source for indirect links with other actors. Regularly the source of diverse information, skills and resources.
- Academic Networks - those linkages that involve ties between the entrepreneur and a particular Professor, Dr or researcher, with a particular research team, a particular research project or even a particular university as a whole. These links often provide the entrepreneur with access to a large amount of research and knowledge for a relatively little cost when compared with undertaking the research in-house.

It is important to remember that the type of link that is established in the beginning of the relationship may develop as time passes and the interactions between the two actors become more frequent. It is not uncommon for relationships that begin as formal ties to become more informal as the two actors develop a relationship through continuous interaction.

Freeman (1991) states the importance of establishing both formal and informal ties, claiming that 'behind every formal network, giving it the breath of life, are usually various informal

networks...personal relationships of trust and confidence...are important at both the formal and informal level'. This would again support the notion that the more diverse the network, the more unique and important will be the resources that are accessible through it.

How Networking Can Facilitate the Opportunity Recognition Process

From this examination of the different characteristics of networks and the different types of networking activities that can be carried out, it is possible to see how the establishment and maintenance of a diverse network may benefit entrepreneurs in the opportunity recognition process.

The use of networks can be significant in gaining information, knowledge, resources and removing barriers or business obstacles (Low and Macmillan, 1988). Through utilising networks, the entrepreneur or firm can also increase the propensity to learn which, in turn, increases the capacity for new wealth creation through the search and recognition of entrepreneurial opportunity (Minguzzi and Passaro, 2000).

Networks can also act as a substitute for some firm competencies (Tidd, 1995) and can involve linkages with competing firms, suppliers, customers (often lead users), distributors, manufacturers, members and units within the organisation and even family, friends and other members of society. These linkages can supply a rich source of diverse information, often required when pursuing technological opportunities. Often, in fact, firms collaborate in order to bring complementary technologies together and access new markets. Tidd proposes that the fusion of converging technologies relies upon the linking of diverse knowledge, requiring ties with suppliers and firms who are able to offer complementary skills and information.

Harris, Coles and Dickson (2000) have suggested that networks are essential in the identification of innovative opportunity and in defining innovation strategies in order to successfully exploit such opportunities. They discuss how networks not only allow access to new knowledge, skills and stimuli that can enable the firm to perceive new opportunity but can assist in learning and risk reduction, allowing more opportunities to be assessed in terms of potential rather than risk. As recognised by Rice, Kelley, Peters and O'Connor (2001), innovative opportunities can be 'risky, costly and lengthy process(es)'.

Research conducted by Conway and Steward (1998) has found that, 'innovation should not be viewed as resulting from a single idea, but from a *bundle* or *ensemble* of ideas, information, technology, codified knowledge and know-how...new ideas seldom appear fully formed and articulated from a single source.' The diverse knowledge and skills that can be accessed through establishing and maintaining networks would therefore be seen as an essential activity for the entrepreneur searching for innovative opportunity. The information, skills and know-how gained from networking activities can greatly supplement the existing knowledge pool that the entrepreneur possesses.

According to Trott (1998) 'The accumulation of knowledge and the effective assimilation and application of this knowledge is what appears to distinguish innovative firms from their less successful counterparts.' Trott suggests that the focus of opportunity recognition should be upon networks as a source of knowledge and the process of linking these with the internal knowledge base of the organisation. This is consistent with the literature on opportunity recognition through entrepreneurial alertness (the coupling of prior related knowledge with new knowledge, information or some other stimuli that leads to an entrepreneurial conjecture or a new means-end relationship) which would again highlight the potential role that networks play in the process of opportunity recognition.

An important consideration to the concepts of utilising networks to gain access to knowledge and skills is clear communications flows. The communication flows between the actors in the network (both internal and external) must be clear if the information and knowledge gained is to be assimilated and clearly understood by the entrepreneur.

If communications between units within the firm and between the firm and the external environment are strong then it is likely that the flow of information and knowledge between the members of the firm and the units of the firm may be sufficient to ensure that opportunities for innovation are recognised and exploited.

Often useful to the communication of knowledge and information flows is the clarification and use of 'gatekeepers' who allow for new information to be filtered, assimilated and communicated successfully within the firm (Allen, 1977). Gatekeepers those individuals who assume a relatively centralised position and assist with information that cannot be easily understood or assimilated by other members within the firm by both monitoring the

environment and translating information into a more easily understood format. This information is then more comprehensible and is then clearly communicated to other units of the firm.

The idea concerning the effectiveness of networks in spotting new opportunity is certainly not contesting the notion of deliberate search or the role that is played by entrepreneurial alertness. In fact, it is suggesting that networks assist in deliberate search for opportunity and, following the idea of entrepreneurial alertness, can create more relevant information, facilitate learning and can open the entrepreneur to new stimuli that can be processed as new opportunity.

2.4 Kirzner vs. Drucker and the Role of Networking

In summary, the theory that surrounds the concepts of deliberate search and entrepreneurial alertness is centred on the propositions made by Drucker (1985) and Kirzner (1979). Drucker argues that if the entrepreneur is active in a systematic search for opportunity and is organised and diligent in monitoring the 'seven sources' then it is likely that they will be able to recognise opportunities as they arise. Kirzner, however, examines the issue of why some people recognise opportunity whereas others do not. This body of theory explains this through a means of cognitive processes and heuristics based around the ability to recognise new means-end relationships and form novel linkages when presented with certain stimuli.

These two concepts appear to conflict in terms of the way in which opportunities are recognised. The literature regarding deliberate search suggests that the opportunity recognition process involves a proactive exploration of the business environment.

In contrast to this, the theory regarding entrepreneurial alertness is more situation-based. Research has suggested that given the correct stimuli some entrepreneurs are able to recognise opportunity whereas others are not. This ability to recognise opportunities is contingent upon the knowledge, skills and information that the entrepreneur possesses and the new stimuli that the entrepreneur is exposed to. Given the correct stimuli, the entrepreneur who possesses the relevant prior knowledge will be able to arrange these inputs in a way that will allow for the identification of an opportunity for innovation.

The two theories do, however, share a similarity in that they both emphasis the importance of gaining knowledge in the opportunity recognition process. Conducting a deliberate search involves learning and knowledge acquisition gained through scanning the business environment, particularly in the areas mapped out by Drucker. Tidd, Bessant and Pavitt (2001) claim that firms must be proficient in learning and changing in response to new and unanticipated developments and that the continuous transfer of knowledge across the firm is essential to the search for innovative opportunity. With regards to entrepreneurial alertness, knowledge and information acquisition is an essential element in the process of opportunity identification. Therefore, this mutual need for knowledge is important in that it gives an indication that the two mechanisms are not necessarily mutually exclusive. It suggests that the most important variable in the search for entrepreneurial opportunity is *knowledge*.

With regards to the potential role of networking, in the deliberate search for opportunity the emphasis placed upon a systematic, managed, and monitored scanning process across a number of areas within the economic and social environment in which the firm operates or plans to operate. The aim of this is to develop an in-depth comprehension of the mechanisms of the business environment and most importantly to monitor and understand changes and shifts in trends that are likely to reveal new opportunities. This gives rise to the importance that lay in the successful accumulation, dissemination and communication of knowledge, skills and information in the search processes within the firm and between the entrepreneur(s) and outside sources. The creation and maintenance of a diverse network of relationships both internally and externally can thus be of great benefit to those entrepreneurs who are looking to embark upon or maintain a routine of deliberate and systematic search for innovative opportunity.

Similarly, with regards to entrepreneurial alertness and the body of theory that relates opportunity identification to cognition and heuristics both prior and new knowledge is essential to the successful recognition of innovative opportunity. The framework that can be derived from the research that has been conducted on entrepreneurial alertness suggests that if the entrepreneur has a diverse and in-depth base of prior related knowledge, then the acquisition of complementary new knowledge can lead to an entrepreneurial conjecture with the output being the recognition of an opportunity.

Therefore, it can be seen that networking activities can positively impact upon the recognition of new opportunities by providing access to new knowledge, information, skills and resources. The gains that can be made through networking can facility the opportunity recognition process through both entrepreneurial alertness and deliberate search.

3.1 Research Aims

As discussed, a large proportion of the literature in this field of research examines the processes and dynamics of *exploiting* opportunity, however, there are still few studies that examine the process of *recognising* opportunity. There is little conclusive research that examines the types of activities, skills, knowledge and practices needed by entrepreneurial firms who wish to recognise exploitable opportunity.

My research aim is to assess the role played by, the effectiveness of and the complementarity between the following two mechanisms in the opportunity recognition process:

a) Deliberate search, and
b) Entrepreneurial alertness

This examination will be further supplemented by investigating the role that is played by networks in facilitating this process by looking at the types of network utilised and the influence these have on the successful identification of entrepreneurial opportunities.

3.2 Research Methodology

Having analysed a number of articles and papers within this research area, it has become apparent that a number of successful research studies have involved the use of case studies as a means of primary research. As a part of the case study in many research papers, questionnaires and interviews (face-to-face, telephone and computer mediated) are used for attaining primary data and this is supplemented by secondary data often in the form of annual reports, trade journal articles, analyst reports, company contracts, internal records etc. Very few of the researchers spent a significant amount of time on the site of the case(s).

For the purposes of my research, I believe that the use of retrospective cases studies will enable me to gain an understanding of the processes involved in the recognition of a wide range of opportunities within a number of different environments, circumstances and

industries. The use of retrospective data will also allow me to analyse the processes by which entrepreneurs have successfully identified entrepreneurial opportunity.

The cases studied are *retrospective* in that they are looking at companies that have successfully searched for and recognised innovative and entrepreneurial opportunity that have led to the creation of a new venture. This is in part due to the time constraints of a six-month research project not allowing on-site prospective case study research, however, it will also allow an analysis of the processes by which opportunity was searched for in a varied range of companies.

The cases will also allow an analysis of a vast number of diverse innovations that highlight the recognition of entrepreneurial opportunity. Essential to the research is the examination of a diverse as possible range of cases in order to try and fully understand the process of opportunity recognition.

The use of case studies is prescribed by Yin (1993, 1994), who suggests that this is often the most preferred approach when:

- Questions of 'how' and 'why' are being asked; (*How* are opportunities recognised and *why* do some recognise them and others do not?)
- The researcher has little control over the events in the case; (Cases being studied are retrospective)
- When the focus of research is on a 'contemporary phenomena' and when
- The phenomena under study are not easily separable form the context they are positioned within.

The use of case studies to research this area is also supported by Stake (1995) who suggests using a number of cases can reveal a more detailed, coherent understanding of the area of research and may also lead to the possibility of creating valid generalisations.

The 49 cases that were analysed in this research study (Appendix 1) were selected from a collection of over 1000 case studies of UK Award winning innovations (Queens Award for Technological Achievement, British Design Award for Innovation, Small Firms Merit Award

for Research and Technology, British Design Award, Prince of Wales Award etc) compiled by undergraduate business school students for Aston University Innovation Research Centre. These case studies were based upon the findings from the cases studied when researched by Aston Business School postgraduate students.

The postgraduate case studies involved the examination of the innovation process that led to the award winning innovation. The information that was used in these cases was compiled through primary research (interviews – telephone, computer mediated, face to face, and questionnaires) and secondary research (trade press, company information documents, annual reports, news articles etc).

Using the information gained from these cases, the undergraduate study involved an analysis of the creation of the firm, the generation of the innovative capability, the entrepreneurial networks involved, the process of change in the firm, significant changes and a critical transition in the development of the firm. Although the basis of these reports was the information gained from the postgraduate analysis, many of the undergraduate reports involved further interviews and questionnaires and additional secondary research in order to update the information and supplement the cases with regards to the analysis that was undertaken.

There are a number of limitations of using this research technique that must be understood and appreciated. Firstly, it must be considered that the case studies that are used for the analysis in this research are themselves based upon prior research conducted into the companies. This would suggest that some elements of the analysis are based upon assumptions that have been made by both the initial researcher and by the secondary researcher. This may raise issues with regards to the information upon which this research is based. However, many of the assumptions made in the case studies did not surround the issues from which this research is based, for example a number of the assumptions referred to a particular individual's role or relationship within a particular project or research team or the entrepreneurs background prior to the case study. In other words, many of the assumptions that were made surrounded issues that neither influenced nor were of significance to the information required in this research.

Another issue regarding the validity of the case studies refers to the methods of research used by the authors. Primary research has been gathered in part by the use of interviews. In terms of the interviews conducted, the majority of the questions asked by the interviewer referred to instances surrounding the conception of the firm, and other such instances that had occurred a number of years prior to the interview. Kvale (1996) has proposed a number of concerns that can affect the validity of the information gained through interviews. These include concerns surrounding the trustworthiness of the subject's account of reality and the ability to be able to successfully recall past events with accuracy, and the interviewer's interpretation of the subject's accounts. As many of the interview questions surrounded events that occurred a number of years ago, there may be a tendency for the participants to view the past rationally and make it appear more orderly and managed than it was in reality.

These issues (that the cases relied on a number of assumptions made by the previous researchers, and that the research also relied partly on a recall of events rather than a direct observation) were taken into account during the process of analysis and were understood with regards to the validity of the research material and the ability to generalise from the findings.

3.3 The Selection and Categorisation of the Case Studies

From the vast collection of research held by the Innovation Research Centre, 49 cases (Appendix 1) were selected for this study on the basis of their suitability for the analysis in the research study. The selection of these cases was based on the innovation matching the criteria of:

a) The recognition of the opportunity to produce the award-winning innovation led to the creation of a new entrepreneurial venture
b) The start-up fell into the time period of between 1970 – 1995

These 49 cases were then divided into three categories of when:

a) Deliberate Search was dominant in the opportunity recognition process,
b) Entrepreneurial Alertness was dominant in the opportunity recognition process
c) Both Deliberate Search and Entrepreneurial Alertness were present.

The case studies were divided into these three categories based upon a number of different features that characterised them as being either deliberate search cases or entrepreneurial alertness cases. Those that fell into the third category were cases in which the dominant features of both mechanisms were present and had a positive impact upon the opportunity recognition process.

Cases were categorised as being 'deliberate search' where the entrepreneur(s) had exhibited an active search or exploration of a particular industry/market/product with the goal being the recognition of a new opportunity. These case studies highlight the entrepreneur(s) explicit desire to identify new opportunities and are accompanied by an explanation of the search behaviour carried out, for example in the case study of Distributed Information Processing Ltd:

> *'They (the entrepreneurs) aimed to satisfy a niche in the market by developing their own product'*

Similarly, in the case study of Conveyors International Ltd. it is noted that:

> *'(The entrepreneur) had a determination that despite the traditional views in the industry, there was room for a specialist manufacturer with core competencies of design and a flair for engineering. He also believed that it was important to seek competitive advantage through both product and process innovation'*

Those cases categorised as entrepreneurial alertness were not merely those cases in which an opportunity was identified without a deliberate search, but those cases where the entrepreneur had recognised an opportunity through the coordination of knowledge inputs, not through the active analysis of particular areas of the business environment. This refers to the identification of an opportunity through the convergence of related stimuli, whether the stimuli were received by chance, through work experiences, networking or some other source that once received triggered a thought process or entrepreneurial conjecture that led to the recognition of an opportunity. An example of this can be seen in the Smokecloak case study,

> *'The innovation itself arose after Dard's Electronics was broken into seven times in eight months. Paul Dards, the owner had fitted all of the burglar alarms and safety devices recommended by the Police (yet) this did not serve as a deterrent to the thieves. A chance comment by a policeman about Mr Dards only being able to slow the thieves down rather than stop them completely, began a though process for Mr Dards. His thought turned to the thick fogs that reduced traffic to a crawl in London, and prompted Paul Dards*

to begin developing a burglar alarm that emitted a fog so thick that a burglar could not possibly steal anything'

This example demonstrates how through the coordination of knowledge and the converging of stimuli, whether through a chance occasion (as in this case) or some other source led to an entrepreneurial conjecture with the output being the recognition of a new opportunity.

From the 49 cases that were studied, twelve of these were analysed in further detail. This exploration enabled the discovery of a number of characteristics that were prevalent in the cases to be recognised, assimilated and discussed in terms of the opportunity itself, the process of opportunity recognition and the role played by networks in facilitating this process.

Of these twelve case studies, four were selected from each of the three categories outlined above (deliberate search, entrepreneurial alertness and when both were present) for a closer analysis. This allowed for a more detailed investigation to be undertaken regarding the process of opportunity recognition in each type of case and for comparisons and conclusions to be drawn regarding the three scenarios in which the opportunity for the award winning innovations were identified.

3.4 Case Study Analysis

Opportunity Related Issues

The basis of the analysis evolved from an understanding of the actual opportunity that was identified by the entrepreneur. From this it was then possible to investigate the types of activities that were undertaken by the entrepreneur, the mechanisms used and the positive influences that led to the successful recognition of the opportunity. The types of areas examined related to the nature of the innovation that was identified (technological, process, service, product etc), whether the innovation was incremental or whether it was an entirely new concept, whether the opportunity was that for a niche or a mass market and/or whether the opportunity was related to a market that the entrepreneur was familiar or whether it was in an area of which the entrepreneur had little experience.

Entrepreneurial Alertness

Important to the study of the cases that displayed entrepreneurial alertness was an awareness of the characteristics of that could have an impact upon the opportunity recognition process. Essential to the concept of entrepreneurial alertness is the extent to which the recognition of the opportunity was a 'flash of insight'. To what extent do the conditions in which the entrepreneur operates play a part in the recognition process? This body of theory suggests that in most cases, when entrepreneurial alertness is apparent in the successful identification of an opportunity, the pattern of

prior related knowledge + new knowledge = entrepreneurial conjecture

is followed. If it is assumed that this is the case in most instances, then the types of prior knowledge and new knowledge that actively assist the opportunity identification are also important. Is the prior knowledge work related or interest/lifestyle related? What was the source of the new knowledge, was it work/career related, interest/lifestyle related or was it born of some chance comment or incident? All of these issues have an impact on developing an understanding of the circumstances and the influences upon opportunity recognition through entrepreneurial alertness and therefore must be considered and understood.

Deliberate Search

Essential to those cases that display evidence of a deliberate search in the opportunity recognition process was an understanding of how the search process was initiated and what types of search practice were evident that led to the successful identification of an opportunity. A number of questions were examined in the analysis of the case studies: How did the entrepreneurs search? What information and knowledge was accumulated through the search process? What resources were required to conduct the search? How specific was the search?

Important to this analysis was an attempt to gain an understanding of how closely the method of search and the gains made from the search followed the framework/understanding of searching for innovative opportunity as outlined by Drucker. Was the opportunity contingent on change and how can the opportunity be classified in terms of Drucker's 'seven sources'?

Networks

As discussed, previous research highlights the significant gains that can be made by entrepreneurs who establish diverse and effective networks. The types of gain that can be made through networking could be of considerable benefit to the entrepreneur in the opportunity recognition process by providing the sorts of stimuli, skills, knowledge and other resources that would assist in identifying opportunity both through entrepreneurial alertness and by means of a deliberate search. The following issues were examined:

- Was a network established?
- What was the extent of the network?
    - What types of relationships were established?
    - Evidence of weak/strong ties?
    - Were ties formal/informal?
- Evidence of internal networks/communications?
- Evidence of different types of network? (academic, scientific, professional, user, friendship, recreation etc)
- Did any actor assume the gatekeeper/boundary-spanning role?
- What gains were made from networking?

It is important to gain an understanding of the different types of network that were present in the cases in order to build a comprehension of the most influential network characteristics and the various roles that are played by the different links within the networks.

4.1 The Analysis of the Case Studies

In analysing the mechanisms by which entrepreneurs recognise opportunities, it is widely recognised that a deliberate and systematic search is often undertaken with some success (Drucker, 1985; Robert, 1993; Christensen, Madsen and Peterson, 1994; du Preez and Pistorius, 1999; Savioz and Blum, 2002).

In the analysis of the 49 retrospective case studies, I discovered that 18 of these demonstrate a deliberate search as being the main contributor to the opportunity recognition process.

The analysis of the ways in which the entrepreneurs actively searched for opportunity revealed a number of key issues and similarities, such as how the search was conducted, the type of search conducted, the methods used by the entrepreneur, the areas in which the entrepreneurs explored and the motive behind the search (developing market niches, incremental innovation, developing market needs etc).

Detailed below are four of the case studies that highlighted the use of deliberate search in the identification of an entrepreneurial opportunity. Through the analysis of these cases a clearer understanding of the processes involved in a deliberate search can be appreciated.

4.2 Conveyors International Limited Case Study

Company Background

Conveyors International (CI) was first conceived in 1982 and operates in the UK market for overhead conveyors. This market is a specialised niche within the materials/mechanical handling industry and is dominated by a small number of large firms.

The market is in a mature state and thus is often avoided by new and innovative firms, deterred by the market being largely characterised by low profit margins driven by firms competing on cost and conforming to industry standards. However, Eric Wright, an entrepreneurial industrial engineer founded CI after a deliberate search led to the recognition of the opportunity to create a specialist manufacturer with core competencies of design and flair and who could suit individual customers within this niche.

Within the industry, a product called the E8 was the industry standard chain design used by many of the large companies. This was a vulnerable product, which was often slowed by maintenance error, high repair costs and regularly suffered lost production costs.

During the 1970's, this was replaced in the industry by the F8 chain, and this gave CI the impetus to further challenge industry standards and uncover a solution that was more effective in terms of both time and cost. After successful identification of ways in which to modify the F8, CI developed the highly successful innovation of the Caterpillar drive unit.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

CI embarked upon the search for a solution to the problems faced by firms operating in the overhead conveyors industry. The E8 industry standard chain design was vulnerable to maintenance error and was costly to the firms in terms of both time and money. The development of the F8 chain improved upon many of the shortcomings of the E8, however, in further modifying the design of both of these products in order to produce their own new and innovative drive unit CI recognised the opportunity that would allow them to successfully start up and operate within what was considered a mature and uninviting market.

Graham Watts, technical director of CI can be considered key to this opportunity recognition process. Watts possessed an in-depth technical knowledge and expertise in this industry and through the internal linkages and communication flows within CI he was able to make the company aware of the problems associated with E8 and F8 chain designs. He instigated a number of brainstorming sessions within the company and was the focal actor in what was a deliberate and systematic search for an opportunity to produce a new design that would allow the company to create improved products for their customers.

Although the success of the 'brainstorming sessions' was limited, it gave Watts further incentive to search for a solution. From this he decided to begin a process known as 'reverse engineering'. This involved examining each individual element of the current industry standard design and looking at ways in which the design and mechanisms could be improved.

He found that the design within the chain ('long and short link'), which had not been modified since 1910, was clearly in need of a re-design and he further searched for ways in which adapting this design would eradicate the problems related to maintenance error.

The company's strategy of managing the process of deliberate search enabled them to identify problems associated with the industry standard chain and that had not been addressed by the F8. CI was then able to enhance the design, creating the catalyst for the new drive unit and thus create a sustainable competitive advantage within the mature overhead conveyors market, which allowed the firm to prosper.

The Role of Networks in the Opportunity Recognition Process

Networking activities played a significant role in the opportunity recognition process by facilitating the accumulation and assimilation of new information, skills and knowledge.

Company founder and entrepreneur Wright came from a user background in the overhead conveyors industry. He recognised the importance of creating and maintaining links with users and thus set about creating a user network involving both CI customers and other users of the E8 and F8 industry standard chains. This enabled CI to keep abreast of both problems that were being faced by users and of any potential changes in the market that were to have

an impact on CI. This information provided CI with invaluable assistance in their search for a solution to the problems that were being faced within the industry.

Alongside this, it is evident that there was a series of internal networks established within the firm to allow for strong communications and thus for the flow of information to be distributed within the firm. The awareness that the problem existed with the initial chain designs was dispersed throughout the firm and this led to the process of deliberate search to find a solution to the problems that were currently being faced. Communication flows within the company allowed for ideas, customer and user information flows and new information to be assimilated and distributed throughout the firm, harbouring a more creative environment.

As previously discussed, if communications between units within the firm and between the firm and the external environment are strong then it is likely that the flow of information and knowledge between the members of the firm and the units of the firm may be sufficient to ensure that opportunities for innovation are recognised and exploited. Research by Savioz and Blum (2002) has found that the ability to gain access to knowledge and then understand, assimilate and communicate this within the firm is a significant factor in the deliberate and systematic search for opportunity. Christensen, Madsen and Peterson (1994) propose that opportunity recognition is contingent upon problem solving and they highlight the significance of knowledge, learning, networking and strategic thinking. All of these factors are evident within CI, highlighting the positive impact made by networking on the opportunity recognition process.

4.3 Distributed Information Processing Ltd Case Study

Company Background

Distributed Information Processing Ltd (DIP) was created in 1986 with the intention of bringing a new innovative technology to market. The founders, Frodsham, Baldwin and Tucker met whilst working together at Psion.

Pooling their collective experience and know-how, the three founder entrepreneurs recognised the wealth of opportunities that existed within the market of computer based systems and thus created a company with the intention of searching for, and exploiting opportunities to satisfy niche markets.

In order to fund their research, DIP started life as a systems consulting firm, however, using the knowledge that they possessed, the information they gathered through means of a deliberate search and the resources they accessed through the successful creation and maintenance of networks, they were able to recognise the opportunity to produce the 'pocket PC'.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity to produce the pocket PC was recognised by the founders of DIP primarily by the means of a deliberate search. Having the belief in their separate skills and the understanding that the computer systems market would yield many potential opportunities, Frodsham, Baldwin and Tucker began a systematic and deliberate search for ways in which they could exploit the numerous niche markets that were being created by the rapidly expanding computer industry.

As mentioned, the company started life as a systems consulting firm in order to both finance the research required to spot emerging opportunities and as a means of supplementing their knowledge regarding computer systems. Given their background working for Psion, the founders were able to recognise that there was an obvious market pull for systems consulting. However, the demand they discovered for the IBM PC-compatible hand-held computer was far more latent and its recognition required a deliberate and systematic search of the market.

Initially the search was hindered by the founders' lack of capital and of information sources that they required in order to enhance their own knowledge. However, they understood that without external perspectives, they were facing the risk of developing products that would have no demand.

To overcome this problem, the founders sought to extend their capabilities establishing links with the external environment. This came largely in the shape of Sir Kenneth Corfield, a personal friend of Frodsham's father and a Director of Midland Bank. This signified a turning point in the opportunity search and proved extremely important in the development of the firm.

Corfield became committed to the project and quickly established a further link with Octagen, a venture capital group, who provided the necessary finance to supplement the research and development into recognising new market opportunities.

In terms of skills and knowledge, Corfield also brought with him information and advice on both technical and managerial issues. He was able to widen the pool of ideas by bringing in complementary knowledge that augmented the in-house R&D that was now being undertaken.

The firm recognised that due to the nature of the industry (fast moving technology) many of the opportunities that were presenting themselves were largely based on a technology push foundation. This made it essential to develop user-need information, and the project team focused upon developing a clear understanding of user information, trends and needs. This led to a successful gauging of the potential market and viable opportunities become apparent.

The deliberate and systematic search of the computer systems market led to the recognition of the opportunity to produce the pocket PC, manufactured through established firms such as Atari and which proved to be a great success for the company.

The Role of Networks in the Opportunity Recognition Process

The case study of DIP is important in that it highlights not only the potential resources that can be gained from the creation and maintenance of networks, but it also demonstrates the extent to which firms who do not seek to establish networks can suffer.

When Frodsham, Baldwin and Tucker left their positions at Psion to establish DIP, they had the intention of developing a product that would exploit one of the opportunities that was being created by the emerging technologies in the computer systems market. They believed that using their collective skills and know-how they would be able to pool their ideas together, spot an opportunity to develop and gain financing in order to pursue this opportunity.

However, although this internal network forged strong communication links between the founders, the lack of an external network meant that the innovative process within DIP was limited. With the nature of the industry creating market opportunities for technology push innovations, the firm needed to extend its network to the external environment in order to both supplement existing knowledge and gain access to capital to fund further research.

The most important link that was established by DIP was that with Sir Kenneth Corfield. The creation of this link signified a change in fortune of the company, and it was from here that the process of opportunity recognition began to take shape.

The opportunity recognition process that is apparent in this case study largely follows the notion set out by Savioz and Blum (2002) when they discuss the 'Opportunity Landscape'. The opportunity landscape is designed to 'identify and anticipate relevant future trends and developments in the company's technological environment by constant and systematic observation of these trends'. The ability to gain access to knowledge, understand and assimilate it and communicate within the firm is a significant factor.

It was through the establishment of the relationship with Corfield that not only was access to supplementary knowledge gained, but also the indirect link with Octagen, the venture capital group, who provided the funding which allowed for the systematic observation of market and technological trends.

This relationship with Corfield also highlights the extent to which valuable network links can be established through a variety of means. In this case it was through a friendship network (Frodsham's father). As noted by Steward and Conway (1994), the creation of friendship networks can often lead to the creation of serendipitous meetings, information and knowledge. In this case, the relationship with Frodsham's father led to the meeting with Corfield and a significant upturn in fortune for the entrepreneur in terms of both knowledge and capital.

4.4 Gems of Cambridge Limited Case Study

Company Background

Gems of Cambridge Limited (GOCL) was a new technology based firm (Tidd, Bessant and Pavitt, 1997) that was established in 1983 after a government computer aided design centre (CADC) project was disbanded.

Whilst under the guidance and financial backing of the British Government, the project team designed both the hardware and the software for the Gemsys 33, a core image processing system. Following this, the Government decided to withdraw funding, leaving the team with the decision to either find their own backers or to disband the unit.

With the backing of venture capitalists, the unit conducted a deliberate search into potential opportunities to improve the products created while backed by the government, and to tailor these for the consumer market. After the recognition of the opportunity to create the Gemsys 35, the group formed the company GOCL.

In 1987, the company launched the Gemsys 35 and within three years had become the largest supplier of Digital Image Processing Systems in the UK and had won the Queen's Award for Technological Achievement.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The GOCL case study highlights an example of where a deliberate and systematic search provided the entrepreneurs with all of the inputs necessary to recognise the opportunity to produce the Gemsys 35 and pursue GOCL as a separate group. The entrepreneurs, having worked together in the government funded project, held a significant level of expertise and highly qualified personnel. Furthering this, extensive research into new product opportunities had already been conducted within the government incubator organisation before the opportunity to produce the Gemsys 35 and establish GOCL was recognised. These factors had put the group on a strong footing to be able to successfully search for new opportunities to innovate.

One of the more prominent features of this case was the commitment shown to research and development in the aim of pursuing new opportunities for innovation. These factors imply that the group had strong intentions to foster a highly innovative and creative environment, in which a deliberate search could be successfully exercised.

The process of deliberate search through intensive R&D was greatly assisted by excellent communications within the firm. As already mentioned, the R&D team spent a great deal of time communicating ideas and findings to each other, which in itself harboured a creative environment. The nature of the firm also assisted in creating an innovative ethos within GOCL. The founders worked as a close-knit team with product champions operating as gatekeepers to assimilate and communicate expert knowledge throughout the team.

The combination of a deliberate search through heavy R&D and the communication flows that existed within the group led to the recognition of the opportunity for an incremental innovation to the Gemsys 33. This, in turn, led to the successful creation of the Gemsys 35, from which GOCL became the largest supplier of Digital Image Processing Systems in the UK.

The Role of Networks in the Opportunity Recognition Process

Networking activities were very evident and influential in the GOCL case study. GOCL established and maintained extensive networks both internally and externally. These links were central to the deliberate search for opportunity.

Internally communication flows were maximised through the establishment of many informal, internal networks. The research team spent between fifty and seventy five percent of their time communicating ideas and knowledge thus creating a highly creative environment. Externally, the entrepreneurs nurtured linkages with Cambridge and Oxford Universities, working groups with the Ministry of Defence, the Royal Aircraft Establishment, the Royal Navy and the DTI, and both current and potential users.

The formal and informal links that were formed with Oxford University, Cambridge University, MOD, RAE, Royal Navy and the DTI gave the entrepreneurs direct access to pure and applied research, which was used to supplement the flow of internal R&D. This

clearly assisted in the search for new product opportunities by providing the quantity and quality of knowledge that would not normally be available had these networks not been established.

The 'user networks' (Steward and Conway, 1994) that were established were the most important in terms of the direction of the R&D that was being conducted. By using relationships with current and potential users, the entrepreneurs were able to gauge the relevance of their development work. They developed an awareness of customers, which, according to Tidd, Bessant and Pavitt (1997) can lead to improved quality and innovation through customer feedback.

User networks are also useful in providing an in-depth and unbiased understanding of their products that is not necessarily available from any other source. Von Hippel (1977) has identified that in innovative activity, it is the user who can often contribute in both perceiving the need for a solution and in the conceiving of a solution. He has discussed how quantitative research into innovation activity has demonstrated that not only have three out of four innovation projects are initiated in response to a perception of user need for innovation, but also that an accurate understanding of the user need is an important factor which distinguishes successful innovation projects and those that fail. His own research has demonstrated that in both major and minor innovations, it is often the user, not the firm, who recognizes the opportunity for innovation. This would clearly have assisted GOCL in their recognition of an opportunity to initiate the incremental innovation of the Gemsys 35.

4.5 Terence Piper Company Case Study

Company Background

The Terence Piper Company (TPC) is a provider of hot and cold drinks dispensed through its patented Freshbrew range of vending machines. TPC was formed in 1977 after founder, Terence Piper, whilst managing his previous company VGL Industries, conducted a considerable amount of research into the vending machine industry.

While manager of VGL, Piper sought to establish close relations with customers in the hope of gaining an insight into user needs and trends. It was here that Piper discovered that the vending machine industry offered a wealth of opportunities for innovation.

With the money raised from selling VGL, Piper was able to conduct extensive research into systematically searching for the most profitable opportunity in the vending machine industry. Due to his lack of experience in design, Piper established a project team, and converging this with his experience and knowledge from running VGL and the insights gained from the user networks he established, he was able to successfully recognise the opportunity to establish Terence Piper Company.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

Having recognised the potential source of opportunities in the vending machine industry, Piper sold his original company, VGL, in order to raise money to supplement his deliberate search for an opportunity to exploit within this industry.

Piper began his search by creating a project team, consisting of three scientists in order to gain access to the knowledge of product design that he lacked. Each member of the team was employed from different sectors, one was a specialist in electronics and computers, one was from the pen industry and the other was a biologist. This allowed Piper to bring together a diverse source of knowledge and skills. The notion of bringing together a diverse as possible range of knowledge and skill is explored by many researchers (Drucker, 1985; Wickham, 2000; Kirzner, 1979; Tidd, 1995). They claim that the accumulation of diverse knowledge is an important factor in the systematic and deliberate search for business opportunity.

The project team was set up in 1977, and it was two years before the first Freshbrew vending machine was produced. During this time, heavy R&D was conducted. The team pooled together their various skills and applied this to the development of vending machines. Piper maintained close links with former and potential users in order to gain an understanding of the changes that consumers would like to see in any new vending machine and to assess any shortcomings of the present vending machines and to search for solutions to any problems.

Piper ensured that the vending machine market was regularly monitored in order to assess any developments or changes that may be going unnoticed by the larger established companies. It was from this research that Piper spotted an emerging consumer trend for healthy food and drink products. At present no other competitor was offering any healthy alternatives, and thus Piper had spotted a potential competitive advantage.

This type of search follows the suggestions outlined by Drucker (1985) in his assessment of successful search for innovative opportunity. Drucker proposes that opportunity search should be both systematic and purposeful. He outlines seven areas which, when monitored, should provide entrepreneurs with opportunities for innovation.

Piper searched many of the areas that Drucker outlines and this led to the recognition of the opportunity to produce these healthy alternatives in the Freshbrew vending machines. The area in which the opportunity was recognised was 'changes in perception'. By scanning the market, Piper spotted the changing attitude towards health that was developing among consumers and was then able to develop his product to suit customer needs before any of his competitors.

From the extensive research that was carried out, the PRS 67 was created which was a great success. Based on meeting the consumer needs of choice and health, the PRS 67 was also more effective than its competitors in terms of maintenance and cleaning. The design of the product enabled minor faults and cleaning to be carried out by users, rather than a maintenance team being required. The combination of these factors made the PRS 67 very successful and can be attributed to the extensive, systematic and deliberate search for opportunity in this market sector.

The Role of Networks in the Opportunity Recognition Process

Informal networks were very useful to Terence Piper Company in the successful recognition of the opportunity to produce the Freshbrew vending machines. Firstly, and as apparent in the successful recognition of many opportunities, Piper established and maintained close, informal links with users. Initially this began when he was managing VGL, and the information he gained access to led him to conceive that there were many opportunities available in the vending machine industry.

After selling VGL, Piper continued to maintain his existing user network, but he also sought to establish links with potential users of any vending machine that he was to produce. This allowed him to monitor the user profile in this industry to the extent to which he was able to recognise the changes in user perception. It was from this that the company was able to establish a strong competitive advantage.

When establishing the project team, Piper ensured that a strong internal network of relationships was formed between the project members. The project team consisted of Piper, his wife and the three scientists. The team was divided into two sections, one concentrating on the production of the machine itself, and the other concentrating on the products sold within the machine. The internal network was established in order to ensure clear communication flows between the two divisions. Piper also acted as gatekeeper between the external network and the internal links within the company. This ensured that any ideas or new information was assimilated and communicated between the members of the project team and that the diverse skills they each possessed were shared between the members, generating a highly creative research team.

In conclusion, it is possible to see how the creation and maintenance of social networks has positively facilitated the deliberate search for opportunity.

4.6 Key Issues from the Case Study Analysis

Through the analysis of the above case studies, a number of important issues, considerations and common characteristics came to light. Perhaps the most important of these issues to be addressed is that of how the search was conducted and the type of search activities that were common to the cases.

In the four case studies that were analysed in greater depth, it is apparent that the search was rarely conducted by the entrepreneur alone. Although in some cases, the entrepreneur performed an initial search that uncovered a concept that they wished to pursue (see discussion below) the deliberate search to find new opportunities was always carried out by a team of actors.

The teams that were involved in identifying the opportunities were fairly consistent in terms of characteristics. Often, the entrepreneur themselves created a team, however, in other cases the decision to search was not conceived by one individual but rather a collection of individuals who themselves formed a part of the research team. However, what is important here is that in none of the cases did one individual carry out the search alone. The cases that were explored demonstrated that the research teams consisted of individuals with a disparate range of skills that were complementary to the areas in which the search was being conducted. For instance, if the search was being conducted into the computer industry to find new niches in the software market, the team may consist of software developers, software consultants, hardware consultants, designers and users.

Thus in the creation of a research team, the entrepreneur(s) looked to supplement their own knowledge and skill base in order to facilitate a more defined and beneficial search (see Table 1 on the following page). The successful search for and thus recognition of opportunity appears to be more likely if the search is conducted by a team of actors with complementary skills and a diverse knowledge base rather than by a single entrepreneur searching alone using only their own skills and knowledge base.

Table 1 – Table Outlining the Formation of Research Teams within Analysed Case Studies.

Company	*Example*
Conveyors International Ltd	Eric Wright, the founder entrepreneur had working experience in electrical engineering in the materials handling industry. In regards to the innovation in this case, Wright had a user background and this gave him an understanding of user requirements, as well as knowledge of the industry and technical expertise that was gained in his previous role. He began CI by appointing Graham Watts as 'technical director' who possessed an in-depth knowledge of technical design, which supplemented the knowledge he possessed. Together they instigated a series of brainstorming sessions involving all CI employees and which examined each individual element of the innovation.
Distributed Information Processing Ltd	Founders, Frodsham, Baldwin and Tucker created DIP as a software consultancy in order to finance and bring new knowledge into their deliberate search for opportunity. Their relationship began with professional ties and by the time they had left their employer had supplemented these with a set of personal relationships. The time that they had been working together for Psion had allowed them to gain a collective expertise in the field of computer systems. Together they enlisted Sir Kenneth Corfield (Director of Midland Bank) and as a group pooled their relevant knowledge into the search. Their expert knowledge in the field of computer systems was supplemented by the knowledge of technical and managerial issues brought to the group by Corfield.
Gems of Cambridge Ltd	GOCL was formed out of a disbanded government computer aided design (CAD) project. Thus using the knowledge gained from the government project, the team embarked upon a deliberate search for opportunity. Due to the team being formed by the government, the necessary combination of knowledge and skills were amassed while the group was still employed by the government. However this still demonstrates an example of when a group of individuals with complementary skills and knowledge have successfully searched for opportunity.
Terence Piper Company	With the goal of identifying opportunities in the evolving drinks vending machine industry, the founder, Terence Piper, created a project team consisting of three scientists with complementary knowledge in order to gain access to the skills and knowledge he lacked. Alone, he possessed knowledge surrounding only the user need with regards to vending machines following his previous ownership of VGL, a vending machine maintenance company. Piper was not an engineer and thus was not equipped with any knowledge of design skill. Thus by creating a project team, Piper supplemented this knowledge base with scientists with backgrounds electronics and computers, biology and the pen industry. These scientists brought with them their knowledge from various fields and applied this to the development of vending machines.

The analysis of the cases also highlights that after establishing a research team in order to carry out the deliberate search for opportunity, the entrepreneurs used a number of different search techniques, many of which were common in all four cases. However there were some techniques that were used by some of the firms and not others which yielded success in the identification of an opportunity. In the cases explored, there were examples of search being conducted both with specific products in mind and more broadly, looking at entire industry segments in order to find niches.

In the cases where the search was conducted more broadly across industry sectors, the entrepreneurs were attempting to find niche markets that were being created by rapidly developing technologies and arguably did not require a product specific search. The cases in which the search was conducted more specifically were those that were focused upon developing a product incrementally or satisfying a *process need.*

However, an important consideration that was apparent from the cases studied was that there were no examples in which the entrepreneur set out on a deliberate but blind search across a number of the areas discussed by Drucker (1985), Robert (1993) or Wickham (2000). No case demonstrated a search conducted across an entire industry or even less specifically with the hope of uncovering exploitable opportunity. As explored in the following table, all of the searches were related to the entrepreneur's current knowledge, skills or competencies.

Table 2 – Table to Demonstrate how Deliberate Search is Related to Prior Knowledge

Company	*Example*
Conveyors International Ltd	Initial search was based upon the notion that the standard designs used within the industry were not effective or efficient and could be improved. This initial search was fairly defined in that it was concentrated on a particular product in a particular industry to which the founder entrepreneurs had working experience. This was then followed by a more specific search into the particular ways in which greater efficiency could be achieved. This search was therefore specific to satisfying a process need. The team looked at each individual element of the industry standard machine and searched for ways in which the design and mechanisms could be improved.
Distributed Information Processing Ltd	An entire industry was searched in this case. The entrepreneurs recognised that growing market niches that were being created throughout the PC market due to its rapid evolution and growth. Therefore, the entrepreneurs searched across the entire industry

	looking at consumer trends in order to identify an opportunity. Initially they used their collective experiences to set-up a systems consulting firm with a product development focus. This gave the team the resources and time in which to fully analyse the market in terms of growth and user trends, customer needs and values and developing and converging technologies. The innovation of the pocket-PC was a technology-push innovation, therefore an extensive search of the market was vital in order to establish potential market acceptance.
Gems of Cambridge Ltd	Using the knowledge based gained through research while the team was government-backed, GOCL conducted a deliberate search specific to a certain product within a specific industry with the aim of creating an incremental innovation. Due to the nature of the innovation being that of new technology, the group had to conduct a specific search into the technology concerning this innovation and the potential market pull.
Terence Piper Company	Whilst researching for his previous company, the entrepreneur recognised the wealth of opportunities for innovation within the vending machine industry. Therefore the search that was conducted looked across the entire industry, looking at different consumer segments and trends, changing perceptions and demographics in order to uncover ways in which the product offering could be adapted to satisfy a market niche.

Two of the cases (as seen on the following page) analysed highlighted change as an important consideration in the deliberate search for opportunity. The entrepreneurs followed the suggestions as outlined by the research that highlights the benefits of routinely scanning the market in terms of competitors and technologies in order to chart changes and identify the opportunities that ensue this change (Drucker, 1985; Christensen, Madsen and Peterson, 1994; Tidd, Bessant and Pavitt, 2001; Savioz and Blum, 2002).

Table 3 – Analysis Highlighting Change as a Catalyst for Emerging Opportunities

Company	*Example*
Distributed Information Processing Ltd	Explored the changes in industry/market structures that were fast creating market niches. The most important change that was occurring was the rapid expansion of the PC market – the number of computers that were being purchased for home use instead of business was increasing. This change was rapid and as proposed by Drucker, rapid growth within an industry and a convergence of technologies allows for the frequent recognition of profitable opportunities.
Terence Piper Company	Explored the changes in perception to the fast food and drinks industry. Recognised the changing consumer trend towards health and energy drinks as opposed to less healthy alternatives. This allowed for the entrepreneur to produce drinks vending machines, which exploited this change in perception as an opportunity by providing healthier drinks as opposed to the product offering that was available through other companies.

Another common feature of the cases was that the entrepreneur was often able to use the resources and knowledge gained from their previous employment in the deliberate search for opportunity. The table below discusses this finding.

Table 4 – The Benefits of Knowledge and Experience Gained in Previous Employment

Company	*Example*
Conveyors International Ltd	Although specific company is not stated in the case, Eric Wright, the founder entrepreneur came from a working background in industrial engineering in the materials handling industry. With regards to the innovation produced in this case, Wright came from a user background and was thus able to utilise the knowledge of user requirements, knowledge of the industry and the technical expertise he gained in his previous role.
Distributed Information Processing Ltd	The three founders met whilst working together at Psion. Their employment in the computer systems industry gave the founders an in-depth knowledge of the computer industry, software and hardware needed to embark upon a deliberate search in this industry.
Gems of Cambridge Ltd	Team worked together on CAD for the government before the project was disbanded. They team benefited from being set up by the government (through employing the team the Government brought founders together in regards to their complementary skills and in-depth knowledge) and from having much of the development work conducted within the Government's incubator organisation before the new venture was established.

Terence Piper Company	Preliminary research was conducted for previous company VGL as founder was looking for ways in which to innovate in the industry segment he occupied at the time (vending machine maintenance). It was in this search that the initial opportunity was recognised, and following this he sold VGL to finance the more substantial search in order to establish Terence Piper Company.

A number of important issues have been highlighted in the above analysis regarding the processes, characteristics and behaviours common in the successful recognition of opportunities through deliberate search. Much of the analysis appears to offer support for the theory surrounding this mechanism of opportunity identification (as outlined in Section 2.1). The main findings from the case study analysis were that the search was always carried out by a team rather than one individual alone, the search was always conducted into a specific area that was related to the entrepreneur(s) current knowledge base and that the opportunities that were recognise were related to the areas as outlined by Drucker (1985) and often highlighted *change* as a catalyst for the opportunity recognition.

The following chapter details the analysis of those cases in which entrepreneurial alertness was the most dominant influence in the opportunity recognition process.

Chapter 5 - Opportunity Recognition through Entrepreneurial Alertness

5.1 The Analysis of the Case Studies

As discussed, the recognition of opportunity through entrepreneurial alertness is based around the notion that individuals have varying capacities regarding cognition, knowledge coordination and heuristics. It is the way in which some individuals utilise information, knowledge and skills in order to recognise 'brief windows of opportunity' whereas others do not (Alvarez and Busenitz, 2001).

Much research has highlighted the ability of entrepreneurs to recognise new means-end relationships as a result of the cognitive processes and knowledge coordination strategies that they possess (Woo, Folta and Cooper, 1992; Busenitz and Barney, 1997; Shane and Venkataraman, 1997, 2000; Alvarez and Busenitz, 2001). Many theorists also highlight the importance of knowledge accumulation and assimilation in this process (Cohen and Levinthal, 1990, Shane and Venkataraman, 1997, Trott, 1998). With regards to this, the knowledge that is gained by the entrepreneur is most beneficial if it is both extensive and diverse and if the entrepreneur endeavours to absorb and assimilate this knowledge. Cohen and Levinthal propose that the accumulation of knowledge is vital to the entrepreneur's ability to successfully recognise opportunity.

Of the 49 cases studied, 19 of these demonstrated examples of where opportunities were recognised by means of entrepreneurial alertness.

Four of these cases were the subject of a more detailed analysis in order to gain a deeper understanding of the processes and common behaviours and characteristics evident in the opportunity recognition process through entrepreneurial alertness

5.2 April Computing Case Study

Company Background

Julio Faria created April Computing Limited in 1985 after leaving his role developing new technologies for the chemical and pharmaceutical giant ICI. Faria decided to establish his own company after having several new technology projects shelved by his employers.

Faria created his own business, largely assisted by his use of relationships that had been built during his time at ICI. He recruited a small number of staff and a marketing manager and moved into the fast-growing market of computer software.

However, when the DTI announced the SMART funding programme for small, innovative firms, April was one of the firms to obtain a cash donation.

The recognition of the innovation in this case was recognised by a means of entrepreneurial alertness.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

As mentioned, entrepreneurial alertness was the most significant influence in the successful recognition of the opportunity to produce the new innovation – in this case an 'automated aseptic biosampler'.

Faria possessed expert knowledge in this area, from his time in the new technology development team at ICI and links with the University of Manchester Institute of Science and Technology (UMIST) supplied this knowledge by providing April with a rich source for technological transfer, research and market information.

The stimuli that would have been provided by the entrepreneur himself, UMIST, staff and former colleagues at ICI allowed for Faria to make a novel linkage that led to the identification of an opportunity when an employee made a chance comment. When the employee declared a need to have something to take samples from the labs at night, Faria

made the novel linkage between prior related knowledge and new knowledge and spotted the opportunity for the innovation of the automated aseptic biosampler.

As could be expected, during research projects it is likely that many ideas can evolve and many opportunities can present themselves, but as discussed, in terms of this research, although opportunities may exist, they are only of benefit to the business or entrepreneur who can actually *recognise* their existence. Faria, when given the correct stimuli was able to process this in a way that allowed him to perceive a new means-end relationship and thus recognise a new opportunity for innovation. In this case, the innovation of the aseptic biosampler was created in order to automate a manual sampling procedure which eliminated human intervention and thus any possible contamination, an opportunity that was yet to be recognised by any of the other existing biochemical company or research team.

The pattern of events that led to Faria recognising this opportunity follows the theory of Shane and Venkataraman (2000) who claim that 'to recognise an opportunity, an entrepreneur has to have prior information that is complementary with the new information, which triggers an entrepreneurial conjecture'. The researchers argue that due to the specialisation of skills no two people share all of the same information at the same time, and this accounts for why the information that is required to exploit an opportunity is not widely distributed among the population.

The opportunity to produce this innovation in the biochemical industry was borne out of Faria being able to make the novel linkage between different sets of prior and new stimuli. However, following the recognition of this initial opportunity, the R&D team at April was able to adapt this innovation to evolving and anticipated market needs. This resulted in the recognition of the opportunity to produce the biosampler for the optic industry, the automotive industry and the refrigeration industry.

The Role of Networks in the Opportunity Recognition Process

The networking activities that were conducted by April Computing were central to the opportunity recognition process through entrepreneurial alertness.

The initial innovation of the aseptic biosampler was recognised through entrepreneurial alertness. Links with ICI, UMIST and the internal networking and communications within April all provided Faria with a rich and diverse source of expert knowledge and information which was supplemented by his own knowledge base.

The link with ICI was important in that it provided April with a number of formal and informal linkages that allowed for knowledge transfer and research, essential in providing Faria with the stimuli necessary to spot emerging opportunities.

The relationship with UMIST resulted as an indirect link with ICI, and served to provide April Computing with a similarly useful source of knowledge and expertise. Higher education institutes often seek relations with SMEs for reasons such as flexibility and the prospect of forging close, personal relationships between members of the institute and the staff of the company. Thus, the indirect link with UMIST soon became a direct link in its own right, and may well have developed into a series of smaller informal linkages between particular individuals or teams.

Faria clearly had an understanding of the importance of networking activities in the innovation process, and he established and maintained a number of links that provided April Computing with a rich and diverse flow of knowledge, essential to new opportunity recognition.

5.3 Knotless Fishing Tackle Case Study

Company Background

Knotless Fishing Tackle (KFT) was established in 1984 by Brian Swinbanks, who when given particular incentives and technical know-how was able to spot the emerging business opportunity to produce a specialist fishing wire that solved problems that were common to all fishermen.

Swinbanks and his brother had been keen fishermen for many years and had moved to the Isle of Mull with the initial intention of starting a business running a charter boat that could be hired for fishing trips in the summer months. This seasonal business was supplemented by the setting up of a fishing equipment shop in the local town.

The recognition of the opportunity came from the convergence of relevant stimuli and technical knowledge. During regular fishing trips, both Swinbanks himself and his customers often highlighted a number of practical problems that the sea angler faces regarding equipment and fishing conditions. One of the more prominent of these problems was that even more experienced anglers had difficulty when cutting their lines for different 'catches'.

During the out of season winter months, Swinbanks, with his designer background spent time developing potential solutions to this problem. It was here that the opportunity to produce new and innovative fishing tackle was converted into a marketable product and thus a new firm.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity to produce KFT's innovatively designed product was recognised out of an amalgamation of stimuli. Swinbanks, when given the correct information and incentives was able to coordinate new knowledge inputs with prior related knowledge and skills he possessed in order to recognise the opportunity to produce innovative products that led to the successful creation of KFT.

There were a number of influences involved in the recognition to produce KFT's innovative fishing equipment. First and foremost, both Brian Swinbanks and his brother were keen anglers. This would have given him both an in-depth knowledge of the practical problems that fishermen face, as well as a partner to discuss such shortcomings and potential solutions with.

When the pair moved to the Isle of Mull in order to skipper the charter boat used for fishing trips, this increased their knowledge base and expertise on the subject of fishing tackle. Here Swinbanks was able to see, day-in, day-out the problems faced by sea anglers when using their equipment.

Due to the seasonal nature of the current business, Swinbanks established a fishing tackle store to supplement his income from the fishing trips. This clearly gave him an in-depth understanding of the current products available on the market.

Another source of knowledge that contributed to the identification of the opportunity id the entrepreneurs time spent as a toy designer, giving him the knowledge of design and thus the ability to assess the feasibility of creating and designing new products.

Given the stimuli of the problem, coupled with his past experience and knowledge as a technical designer, an experienced fisherman and as the owner of a fishing equipment shop, Swinbanks was able to conceive of the opportunity to couple his technical know-how with a customer need with the output being the conception of the designs that led to the creation of KFT.

Research suggests that to recognise an opportunity, entrepreneurs must have prior information that is complementary to new information which allows for the recognition of a new means end relationship (Kaish and Gilard, 1987; Shane and Venkataraman, 1997; Cohen and Levinthal, 1990). The ability to relate prior knowledge with new knowledge is a major source of innovation in that it allows for novel linkages to be made. Swinbanks was able to use his prior related knowledge and identify a novel linkage once subjected to the new stimuli and complementary information.

The Role of Networks in the Opportunity Recognition Process

Here is an example of where the role of networks had less of an influence on the recognition of the opportunity than the entrepreneur's own skills and knowledge. Swinbanks, through knowledge gained through employment and his keen interest in fishing possessed all of the prior information he required in order to spot the opportunity for innovation once he was made aware of the problem the anglers faced.

Swinbanks not only had all of the necessary information available to him without the use of networks, but he also had two separate businesses which further supplemented his knowledge and gave him the time and outlets in order to design what was to become KFT's innovative products. Therefore, the only links that were present that assisted with the opportunity recognition were those with his family and with the customers of his two other businesses.

Both of these linkages can be defined as user networks to some extent and both satisfied a similar role. The link with his brother can be defined as being both informal and strong assisted in supplementing Swinbanks knowledge on the current fishing equipment available and on the problems that fishermen face. In this linkage, both Swinbanks and his brother, although unaware at the time, were potential users of KFT's products and were able to discuss both the shortcomings of the current equipment available and potential solutions.

This knowledge was greatly supplemented by the vast number of potential users that Swinbanks was in contact with while skippering his charter boat. It was here that the problem of the fishing line was initially put to the entrepreneur, allowing for the novel linkage to be made.

It can also be assumed that a number of informal links with customers both on the boat, and in the shop were made and were able to offer knowledge, advice and recommendations to Swinbanks.

5.4 NextBase Case Study

Company Background

NextBase Ltd was created in 1987 with the intention of developing and marketing route-finding software.

Although navigational, route-finding software already existed in 1987, it was written and designed for large mainframe computers with large memories that were capable of accommodating the large quantities of geographical information that was required. However, the opportunity that was recognised by Dr. Simon Anthony was to capitalise on the mass PC market of both home and business.

The idea to produce route-finding software originated after Anthony read a report from the Department of Transport that stated that software mapping systems could reduce the time and money spent on travel by up to 20%. Recognising the potential to market such a product coupled with the rapidly growing PC market, the opportunity to develop NextBase was conceived and the company developed AutoRoute, a route-planning package that was aimed at individual PC users and which has gone on to become one of the most successful software packages in the market.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The recognition of the opportunity to design and market route-finding software for home and business PC use was undoubtedly due to the entrepreneurial alertness of the founder.

Anthony recognised the opportunity to establish NextBase after the converging of a set of stimuli including new knowledge, prior related knowledge and technical know-how. In essence, the case study highlights a clear example of when the process of entrepreneurial alertness leads to the recognition of an opportunity for innovation.

Before establishing NextBase, Anthony was a computer software consultant, with presumably an in-depth knowledge of the limitations of PC software and hardware

capabilities currently available. This would also have given Anthony an in-depth level of knowledge regarding the PC market and the potential growth signals that it was showing.

The new information that Anthony was exposed to that led to the 'flash of insight' came in the form of the report from the Department of Transport. This new information, when added to the existing knowledge and expertise that Anthony possessed triggered an entrepreneurial conjecture. Anthony perceived that if he was able to develop a software programme that could reduce the required size of computer memory, create a user-friendly interface and enable his product to remain affordable he would be able to capture the mass PC market of both home and business users.

He knew that he would have to market his product effectively in order to educate consumers in the applicability of routing software, however, if this was achievable then he would be able to use the increasingly widespread acceptance of PCs to uncover a potentially large market, within which it was likely that further opportunities would become apparent.

Kirzner (1979) sees 'entrepreneurial alertness' as the ability of the entrepreneur to see where the opportunity for new innovation exists or where new areas for opportunity have emerged. This case study offers a clear example of 'entrepreneurial alertness'. At the time of the innovation, there were many individuals who were equally knowledgeable in computer software and computer systems as Anthony, and as stated, navigational software did already exist for large mainframes. All of the information that Anthony was able to translate into an opportunity for innovation was available to others, however, it was Anthony's behaviour patterns, use of knowledge and thus entrepreneurial alertness that allowed him to perceive of the innovation.

The nature of the opportunity recognition in this case is important in that it clearly highlights the role of entrepreneurial alertness. As Anthony was not given any specific information that other entrepreneurs or companies would not have known or had access to, there is absolutely no evidence of a search apparent. Anthony, when exposed to certain stimuli was simply able to make the connection and recognise the opportunity to develop route-finding software. This is a concept that is discussed by Shane and Venkataraman who have researched the nature of opportunity recognition with regards to the individual's ability to recognise new *means-end relationships*. They propose that even in cases when the individual possesses all

of the information and skills that are necessary to be able to recognise the opportunity, they may fail to due to their cognitive skills and heuristics. Their research highlights that people differ in their ability to identify opportunities due to their ability to link together previous information with new concepts and ideas.

The Role of Networks in the Opportunity Recognition Process

The case study highlighting the creation of NextBase is unique in the case studies that I have examined in that the role of networks in the recognition of the opportunity to produce route-mapping software is limited.

As discussed, the information and knowledge that Anthony linked which led to the recognition of the opportunity was largely available to many firms and entrepreneurs, however it was his entrepreneurial alertness that allowed him to process this information as an opportunity. The prior related skills and information that he possessed were gained through his previous work as a software consultant. The new information that sparked the recognition process was gained by reading a report by the Department of Transport. In recognising the opportunity that led to the creation of the firm NextBase, Anthony did not utilise any networks that he may have already created, nor did he draw upon information and skills by creating new links.

However, this case study does not discount the establishment and maintenance of networks from the innovation process entirely. After the creation of NextBase, a number of links were established, both internally (with members that were added to the team spanning specialised skills in marketing, technology, finance and management consultancy) and externally (user networks, links with Ordinance Survey, Metagraphics Software Corporation and suppliers).

5.5 Smokecloak Case Study

Company Background

Smokecloak was established in 1992 with the aim to manufacture and sell a unique burglar alarm system that once activated emits a harmless smoke that can reduce visibility to approximately 30cm. The innovation was conceived by Paul Dards, owner of Dards Electronics, who was dissatisfied with the current burglar alarms available after his company was broken into seven times in eight months.

The initial idea for Smokecloak came after a chance conversation with a policeman who suggested that burglars could rarely be stopped, only slowed down. From this Dards began to consider methods by which burglars could be slowed. This thought process led to the recognition of the opportunity to produce this unique product. Dards considered situations in which poor visibility affects performance and his thoughts turned to thick fog that reduced traffic to a crawl across London. From this he conceived the idea that if the burglars visibility could be reduced, not only would they not be able to see the items that they wanted to steal, but they would also be slowed down long enough for the police to be able to catch them.

The initial idea for the product was reactive solely to Dards' needs, however, once local businesses came to hear of the idea, interest was aroused which led to the realisation of the commercial opportunity that the innovation possessed.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity to produce Smokecloak alarms was recognised by Paul Dards in a way that could be described as a 'flash of insight' (Kirzner, 1979). This innovation demonstrates an example of where entrepreneurial alertness was the key factor in the opportunity recognition process.

Having created and managed Dards Electronics, Paul Dards clearly has expert knowledge of electronics and in running his own business enterprise. However, he was not a security

expert, his only knowledge being that of the numerous security devices he had purchased which had unsuccessfully protected his property.

Prompted by his own company's security problems, he began to consider solutions to bring to an end the recent numerous break-ins. Here we see how the bringing together of different related stimuli was processed with the output being an exploitable opportunity for innovation. Dards possessed electronics knowledge, which may have assisted in assessing the viability of the situation and he had basic knowledge of the types of security devices that currently existed on the market (and the knowledge that many of these were not adequate). When this existing knowledge was coupled with the need for a new alarm system, the rise in burglaries (especially for Dards Electronics) and the input of the policeman's comment (which triggered the creative thought process), Dards was able to link together these stimuli in a novel form that triggered the recognition of the opportunity.

In this case study it is possible to see Dards' ability to recognise a new *means-end relationship*. According to Shane and Venkataraman (2000) even when individuals possess all of the necessary information they may not be able to process this in a way that highlights an opportunity. They claim that prior research is able to show that different individuals differ in terms of their ability to link together information to find new relationships, however, Dards, when exposed to these stimuli was able to uncover the link between his problem of not being able to find a sufficient burglar alarm system, with the opportunity to create a unique product which would not only solve his own problem, but would also be marketable to a number of other businesses.

The Role of Networks in the Opportunity Recognition Process

Networking activities provided Dards with the sources of knowledge that assisted in the opportunity recognition process. Dards was faced with a problem and a number of different stimuli and from this he provided a solution. His relationships with these actors may have provided the stimuli and information that allowed him to establish the means-end relationship which solved the problem, but the role that was played by networks also extended to assist in the recognition of the commercial opportunity. Thus, although the conceptualisation of the Smokecloak alarm was borne out of a 'flash of insight', the role of networks was prominent

in the providing of stimuli and in the recognition of a marketable opportunity (not just an opportunity to solve a personal problem).

First and foremost, a network of relationships within Dards Electronics is evident, with a number of actors from within the company being considered experts in this particular field. One of the most influential actors from within Dards Electronics was Simon Imbert, who was the marketing manager. It was he who used his marketing and commercial knowledge to recognise and advise Dards that his innovation had commercial potential.

Other actors from within the firm provided a set of informal links that provided Dards with all of the technical know-how and expertise required to create the Smokecloak alarm and turn it into a commercial product rather than just a solution to Dards' own security problem.

One of the most important actors in Dards' network also played a prominent role in the process of creating a commercial opportunity rather than a personal solution. This actor was JEM Theatrical Smoke Company. JEM were able to advise Dards on all aspects of the 'smoke' devices and provide information on suppliers, manufacturers and customers. JEM were then able to develop and supply the Glycol smoke canisters and dispensers for the Smokecloak burglar alarm system.

Dards also established a number of informal links with local businessmen and the local police force, all of which were able to offer knowledge, advice and recommendations.

5.6 Key Issues from the Analysis of the Case Studies

The main idea that was explored in the above case studies that opportunities are recognised through entrepreneurial alertness when:

> *New knowledge is received that is complementary to some prior related knowledge and this leads to an entrepreneurial conjecture with the recognition of an opportunity as the output.*

By exploring the cases it was possible to uncover the types of opportunities that were identified, the types of knowledge that were important, the source of such knowledge, the source of new knowledge/stimuli that encouraged the recognition of opportunity, the different types of stimuli that impacted the process and the role played by chance.

Of the four cases that were analysed in detail, the types of opportunities that were recognised were interesting in that a majority of the innovations were related to a *process need* (as discussed in Section 2.1). This can be seen in the table below. In all of the following cases the opportunities that were identified related to the improvement of an existing product or process.

Table 5 – Table to Show Opportunities Related to *Process Need*.

Company	*Example*
Knotless Fishing Tackle	The entrepreneur, with the knowledge gained through his interest in fishing and his other businesses (a charter fishing boat and a fishing tackle shop), recognised the opportunity to develop solutions to the problems that fishermen were facing with the current tackle and equipment available i.e. the problem that even experienced anglers faced when cutting their lines for different 'catches'. This allowed the entrepreneur to create new innovations to solve these problems.
April Computing	The opportunity for innovation was that of an 'aseptic biosampler'. This improved the process of an important sampling procedure in the biochemical industry by automating a delicate procedure. This eliminated human intervention and thus removed any chance of contamination or human error. The innovation addressed an existing market and application, but satisfied a heavy need. As proposed by Drucker, with *process need* opportunities, there is often an awareness of the need yet it is not often addressed. However, as soon as a solution is provided the innovation is immediately accepted as obvious and soon becomes standard.

Smokecloak	The opportunity for innovation as recognised by the founder of Smokecloak, improved upon the process of stopping/discouraging intruders by creating an innovative burglar alarm. His product improved this process by rendering the intruder immobile and reducing visibility with the use of theatrical smoke. The combination of this need, the realisation of its commercial potential and the entrepreneurial alertness of the founder entrepreneur allowed for the successful development of Smokecloak as an improvement upon the current process of property security.

Interestingly, one case *not* demonstrating *process need* (shown below) also fitted into Drucker's 'Seven Sources of Innovation' in that the opportunity capitalised upon changes in market structures and changes in demographics.

Table 6 – Case Study Showing Market Structures and Demographics as a Source for Opportunity.

Company	*Example*
Nextbase	Although this case did not highlight an example of *process need*, it did follow Drucker's assumptions in that it demonstrates change as a source of innovation. In this case, the entrepreneur capitalised upon the changes in market structure, the changes in (socio)demographics and the changes in perception. The innovation capitalised upon the change in the PC market that was shifting more towards home-users instead of business-users and the change in that there was a growing number of homes that now owned PCs and were becoming more accepting of the technology. The entrepreneur perceived that if he could produce route finding software that would reduce the size of memory required by the computer, make it user friendly and more affordable then the product would capture the rapidly expanding PC markets of both home and business users.

The analysis also demonstrated that in all of the cases investigated, the process of opportunity recognition followed the framework as discussed in Section 2.2 (See table on following page)

> *Prior related knowledge when supplemented with complementary new knowledge results in an entrepreneurial conjecture and thus the recognition of a new opportunity.*

Table 7 – Cases Highlighting the Framework Discussed in Section 2.2

Company	*Example*
Knotless Fishing Tackle	In this case the prior related knowledge was gained through the entrepreneurs own interest in fishing, his ownership of a charter fishing boat and of a fishing tackle shop. The complementary new knowledge that led to the entrepreneurial conjecture came in the form of practical problems that were communicated to him from customers, specifically those with regard to problems with fishing tackle. The combination of the entrepreneurs extensive knowledge of fishing tackle and his own experiences as a fisherman, coupled with the awareness of the problems regularly being faced by fishermen, communicated to him on the charter boat led to the recognition of the opportunity to confront these problems and find solutions which would address the process need.
April Computing	Prior related knowledge was gained by working for the pharmaceutical giant ICI as a technology developer and through links with UMIST which had assisted him while in this role. The complementary new knowledge was a *chance* comment made by a former employee who declared a need to have something to take the samples from the labs at night. This triggered the process of opportunity recognition for the entrepreneur who coupled his technical know-how with his new awareness of the problem in order to discover a solution.
Smokecloak	With regards to the opportunity recognition that led to the creation of Smokecloak, the prior related knowledge was gained by the entrepreneur as the owner of an electrical store. From this he had clearly accumulated an in-depth knowledge and understanding of electronics and the viability of potential products. He also had a basic knowledge of existing burglar alarms having purchased many and been dissatisfied with all of their performance. By *chance*, the new, complementary stimuli was provided by a policeman who commented that it would be more effective if the focus was upon slowing the burglars down rather than trying to stop them completely. This prompted the entrepreneur to begin the development of a burglar alarm that emitted a fog so thick that the burglar could not possibly steal anything and would slow the burglar down so that he/she was still on site when the police arrived.
Nextbase	Before establishing Nextbase, the entrepreneur worked as a software consultant. This gave him an in-depth knowledge of the viability of software capabilities and of the PC market changes and shifts. The new complementary information that triggered the conjecture came in the form of a report written by the DTI that highlighted that route-finding software could reduce travel time by up to 20%. The entrepreneur was aware that route-

	finding software already existed, however, it was programmed for large, mainframe computers that had substantial memory capacities. However, the knowledge he had accumulated from his previous employment, when coupled with the new stimuli advocating the use and benefits of route-finding software, allowed the entrepreneur to recognise the opportunity to capitalise on the growing PC market and the developing technologies of PCs to allow him to generate user-friendly software that would be accessible to both home and business PC users.

Importantly, in all of the cases the opportunity that was recognised was largely related to an area in which the entrepreneur was an expert or had extensive knowledge. In no cases did the entrepreneur spot an opportunity that was in a field that was completely new to them. This would appear to highlight the importance of knowledge in the opportunity recognition process – in no case was an opportunity spotted after the entrepreneur received only new and unrelated stimuli.

In all of the cases examined, the prior knowledge that was important to the recognition of the opportunity was gained through work experiences (see below). In some cases this was supplemented by a personal interest in the subject area. However, it is an important consideration to make that the type of knowledge that initiated the recognition process is harboured within a business environment.

Table 8 – Table Highlighting the Importance of Knowledge Gained Through Work Experiences

Company	*Example*
Knotless Fishing Tackle	Knowledge gained from working as skipper of a charter fishing boat, owner of a fishing tackle shop and through a personal interest in fishing.
April Computing	Knowledge gained through working in the new technology development team at the pharmaceuticals firm ICI. This gave the entrepreneur an extensive knowledge base of new technological developments within the field in which he recognised the opportunity to produce the 'automated aseptic biosampler'.
Smokecloak	As owner of Dards Electronics the entrepreneur gained extensive knowledge with regards to electronic goods, the possibilities and limitations of working with electronics and an awareness of the current technologies available.

Nextbase	Knowledge was gained as a software consultant in previous employment. This gave the entrepreneur extensive knowledge with regards to the software and PC markets, an appreciation of the current software available and attentiveness to the developments in the PC market.

Another important finding that relates to this is that in the only case in which the expert knowledge was equally supplemented by a personal interest/hobby in the subject area, this is the only case in which the new knowledge that triggered the entrepreneurial conjecture was not received by chance. In all of the other cases, the new knowledge was received by chance through a comment that was made, or some other coincidental stimuli. Thus it is important to emphasise the role played by chance. However, equally as important, is an understanding that although the new knowledge or stimuli was often received by chance, it was the entrepreneur who was able to identify the novel linkage due to the actions, behaviours and cognitive skills exhibited with regards to knowledge accumulation and assimilation.

The source of the new knowledge or stimuli is also significant. It is important to highlight that although in many of the cases the new knowledge was related directly to the area in which the opportunity was recognised, it was also apparent in some cases that the new knowledge was *indirectly* related to the new innovation. This suggests that although the new knowledge is often complementary, it is not necessarily directly related to the industry/product/process etc that the opportunity is found within. Thus, as long as the entrepreneur has developed a wide and extensive prior knowledge base, then the receiving of unique and unrelated information can also lead to an entrepreneurial conjecture.

This analysis has shown that, first and foremost, the framework as set out in Section 2.2 is evident in all of the cases examined. This has important implications in that it demonstrates the role played by knowledge accumulation and assimilation in the opportunity recognition process. The analysis has also highlighted the common behaviours of the entrepreneurs who have successfully identified opportunity through entrepreneurial alertness and has explored at the means by which knowledge was accumulated and the common sources of such knowledge.

The following chapter looks at those cases in which both entrepreneurial alertness and deliberate search were present in the opportunity recognition process.

Chapter 6 - Opportunity Recognition through both Entrepreneurial Alertness and Deliberate Search

6.1 The Analysis of the Case Studies

In 12 of the 49 case studies that were examined, it was evident that both entrepreneurial alertness *and* deliberate search were present in the successful recognition of an opportunity. This is an interesting finding as it demonstrates that the two means of identifying opportunities are not necessarily mutually exclusive.

What was important in examining these cases was the ways in which the two means of opportunity recognition complemented each other. By investigating four of these cases in greater detail it was possible to explore areas such as, whether one of these influences more dominant, and did similar patterns of entrepreneurial alertness and deliberate search emerge to those patterns discussed in the previous case studies in which they were the only influence?

Through the analysis of four of these cases, the relationship between entrepreneurial alertness and deliberate search and the complementarity between these mechanisms is explored in detail.

6.2 Elonex Case Study

Company Background

Israel Wetrin, an Israeli born emigrant, established Elonex in Britain in 1986. The venture was created after he successfully coupled together a number of different inputs, which allowed him to perceive that an exploitable opportunity had emerged in the PC sales market. In researching information for a new business venture that Wetrin had become interested in, he soon discovered that the cost of acquiring a new PC could be greatly reduced if new means of purchasing were explored. Wetrin discovered that by importing generic PCs directly from Taiwan, the customer could receive an equally competent PC for a fraction of the price than if they were buying from one of the more established companies such as IBM or Compaq.

He placed an advertisement in a well know PC magazine, offering generic PCs through direct mail order at prices that were well below those of competitors and the response from this led to the founding of Elonex.

This opportunity to improve the service and product provision was recognised through entrepreneurial alertness and following this a deliberate and systematic search was conducted in order to uncover more specific ways in which to develop this opportunity and innovate further in this industry.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity that was recognised by Wetrin was that of enhancing the service and product provision in the PC mail order market. The initial opportunity to explore the growing PC market was recognised through entrepreneurial alertness. Once this opportunity had been perceived, a deliberate search was conducted with the aim of redefining the PC mail order market.

Two employment experiences may have assisted Wetrin in providing information and knowledge stimuli that, in turn, may have assisted in his recognition of this opportunity. Firstly, having worked in the import-export business in Taiwan, Wetrin will have already

possessed knowledge and expertise in this particular area. He would have had knowledge on the ins and outs of exporting from Taiwan (costs, regulations, time expectations etc), and would have had access to contacts that may have provided information and resources.

Secondly, having worked as a PC dealer for some time in Taiwan, Wetrin would have had an in depth knowledge of the market and consumer trends.

These stimuli, or knowledge sources, when combined with the types of stimuli Wetrin was exposed to in researching information on PCs for his new business venture led to Wetrin recognising the opportunity for mail order PCs at a cheaper cost through importing generic PCs from Taiwan.

This is a clear example of 'entrepreneurial alertness' in that an entrepreneur has been able to recognise an exploitable opportunity through processing stimuli in a particular way, with the outcome being the opportunity. This seems to follow theory that suggests that in order to recognise opportunity entrepreneurs must possess prior related knowledge that is complementary with new information, and when these factors are present, an entrepreneurial conjecture will be triggered (Kaish and Gilard, 1987; Shane and Venkataraman, 2000). Furthermore, the ability to relate prior knowledge with new knowledge is considered a major source of innovation (Cohen and Levinthal, 1990).

Following the recognition of this initial opportunity Wetrin developed a series of informal relationships with end-users. These links allowed Wetrin to conduct a systematic and deliberate search of the market, user needs and concerns, and opened the possibility of further opportunities being recognised. This search was extended into developing relationships on a more formal level with different suppliers.

Through this deliberate search of consumer and market related areas, Wetrin was able to recognise the concern that was being held by consumers, and thus manufacturers and rival companies. This was that the increasing pace of technological developments in the PC market was beginning to lead to newly bought and existing PCs becoming obsolete with increasing rapidity.

This led to Wetrin being able to identify the opportunity to provide easily upgradeable PCs by providing PCs that were compatible with a processor card which upgrades the power of the PC.

Following this, a further opportunity was recognised through the deliberate and systematic search of customer wants and needs. Wetrin recognised that competitors offerings were not matched exactly to the ways in which consumers were placing value on the product, and thus he realised an opportunity to increase the perceived value of the product offering of Elonex.

As the situation stood, most suppliers offered PCs with a supplementary box of disks that contained the various software packages that the consumer required. However, it was the responsibility of the consumer to load these software packages onto the machine and configure the settings themselves. Wetrin realised the opportunity to increase perceived value by offering the consumer a machine with pre-loaded software, and he coupled this by capitalising on the lack of this service by other companies. This was achieved by creating a company called Response Computer Maintenance Ltd, which offered the service of configuring and maintaining PCs that were not necessarily pre-loaded.

From this case, it is possible to see the different ways in which opportunities can be recognised. The initial idea for the setting up of Elonex was uncovered through entrepreneurial alertness. Wetrin was opened up to the correct stimuli, and when this was coupled with prior related knowledge, he was able to process it in a way that enabled him to spot the opportunity. However, following the initial opportunity identification he used links with suppliers and customers in order to systematically search for new opportunities that would improve the company's offering and add new value.

The Role of Networks in the Opportunity Recognition Process

In terms of the initial opportunity to create Elonex, it is clear as to how networking activities assisted in the opportunity recognition process. Wetrin had made use of his experiences in both the import-export trade and in PC trading whilst in Taiwan and he established links which gave him access to the type of knowledge needed to recognise the opportunity.

However, the role that was played by networks is much more evident once the deliberate search had been started. Wetrin made a conscious effort to develop and maintain informal relationships with end users. Links with users have been recognised as being an important knowledge source for firms looking to identify emerging opportunities and increase their innovative capacity. Von Hippel (1977) has identified that in innovative activity, it is the user who can often contribute in both perceiving the need for a solution and in the conceiving of a solution. This was certainly the case with Elonex. Wetrin's networking activities involving both users and suppliers allowed for a deliberate and systematic search of possible new developments and user wants and needs, and allowed for him to match product offerings with consumer needs much more quickly than competitors. Networking activities allowed the opportunity to be recognised in that users were able to offer feedback over quality and service and the formal relationships with a number of suppliers allowed for Wetrin to search for opportunities to enhance Elonex's offering and to find new solutions.

Wetrin himself, due to his experience and his knowledge acquired from obtaining a degree in electronic engineering, was able to initiate the 'boundary spanning' role, ensuring clear communication flows between himself, users and alternative suppliers.

This case study clearly shows the benefits that can be gained through user networks. When coupled with effective communication flows between the entrepreneur and the users, these networks can provide invaluable, unique and unbiased information and knowledge regarding the identification of an opportunity.

6.3 Hydraroll Ltd Case Study

Company Background

Richard Webb formed Hydraroll in 1978. As a cargo expert for the Royal Navy, he was closely involved with the Navy's dock loading system. Whilst working in this position Webb formed a user network in order to assess the perceived inefficiencies and limitations of the current technologies available. It was through this network that Webb conceived the idea of creating Hydraroll based on his experiences and the knowledge that he had gained from his role in the Royal Navy.

Hydraroll's core product is a materials handling system that is able to move loads to and from road haulage vehicles with significant ease and speed. The innovation from which Hydraroll was born concerns a pneumatic roller track with an innovative slip-chain that not only improves speed and efficiency but also enables the unloading process to become fully automated.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity to innovate in the cargo handling industry was recognised by Webb by means of both deliberate search and entrepreneurial alertness.

While working for the Navy, it has been noted that Webb was responsible for assessing the inefficiencies and limitations of the Navy's dock loading systems. The establishment of user networks gave Webb direct exposure to a variety of relevant information and knowledge regarding the processes of loading systems. This information was then further supplemented by the professional networks that were established with colleges in the Navy with whom he was able to discuss possible solutions to the problems that he was discovering.

While Webb was working to find solutions and improvements to the loading mechanisms that were currently employed in the Navy's dock loading system, the opportunity to create his own start-up was conceived. This offers a clear example of where a given set of stimuli, when coupled with complementary existing knowledge can result in the recognition of an opportunity.

In this case, Webb was knowledgeable in the mechanisms of cargo and dock loading systems and through his work and professional networks was constantly exposed to the solutions that remedied the common problems with the cargo loading systems that were currently available. Further stimuli was provided by the recognition of the emerging age of 'just in time' delivery that emphasised speed and efficiency, and from this Webb was able to recognise the opportunity to create his own business supplying cargo loading solutions which would satisfy the specific niche market in which greater speed and efficiency were required.

From the recognition of the opportunity to create innovative cargo loading solutions, the innovation process within Hydraroll demonstrates how a deliberate search for specific opportunities was then embarked upon.

Hydraroll established a set of project teams, which allowed for a diverse range of knowledge and experience to be infused throughout the company. A sales team was established, with individuals acting in boundary spanning roles in order to provide a linkage between the firm and users. This ensured that the information accessed through user networks was assimilated and distributed throughout the firm.

The design team, ran by Kenneth Cook was established in order to assess the information that was gained through user networks, to explore the possibilities that were developed by Webb and to search for further solutions that had become apparent through researching the cargo loading industry.

This search led to the recognition that with the increasing need for speed and efficiency, a demand was growing for a fully automated dock loading system, and given Hydraroll's position they were able to deliver an innovative solution before their competitors.

The Role of Networks in the Opportunity Recognition Process

From the analysis of the case it is possible to see how the process of opportunity recognition at Hydraroll would not have been possible without the creation and maintenance of networks – both internal and external.

The initial conception of the idea to create a new firm to produce innovative dock loading systems was born out of the professional and user networks that Webb established while working with the Royal Navy. It was here that Webb was able to further his own knowledge and expertise regarding dock loading systems, but was also given access to information regarding both problems and solutions with the systems that were available at that time.

Once Hydraroll was established, Webb ensured that there was a clear communication flow throughout the firm. Internal links were set up between the different teams, ensuring that all relevant information was assimilated and distributed to the relevant individuals. This was particularly important to Hydraroll when considering the source of information that they had tapped by establishing numerous close links with customers.

The success of the user networks was largely due to the importance that Hydraroll stressed on the employing of 'gatekeepers' to assume boundary-spanning roles within the firm.

Research suggests that essential to the process of creating networks to gain access to knowledge and skills is clear communications between actors that are outside of the firm and the different units within the organization. Gatekeepers are members of the firm who assume a relatively centralised position and assist with information, which cannot be easily understood or assimilated by other members within the firm, by both monitoring the environment and translating information into a more easily understood format. This information is then more easily understood and is clearly communicated to other units of the firm (Savioz and Blum, 2002; Cohen and Levinthal, 1990; Allen, 1977).

This can be highlighted in the case of Hydraroll spotting the opportunity to produce their innovative 'slip-chain system'. The original concept was conceived through one interaction between a member of the sales team and a customer who commented on the difficulties that their company was experiencing in handling increased volume of goods via the existing system, a 'roller track'. From this interaction, the information gained was assimilated by that member of staff and through the web of internal networks was able to quickly and clearly communicate this information throughout the company to Kenneth Cook and the design team. From this the opportunity to produce the slip chain system was recognised and exploited.

6.4 Hydro Research & Development Case Study

Company Background

Hydro Research & Development (HRD) was established in 1980 after the founder entrepreneurs, Bob Smisson and Tim Lamb, recognised the opportunity that a technology that had been developed by a family member could have on the storm water and sewage treatment market.

The technology that led to the creation of the firm is based on an invention by Smisson's father Bernard, who developed pioneering work on the principles of hydrodynamic separation in the 1930's.

Bernard Smisson continually developed this work during the next forty years and in the late 1970's Tim Lamb and Bob Smisson were able to recognise the impact that this technology could have on the British market.

Through the means of entrepreneurial alertness, the two founder entrepreneurs recognised the opportunity to develop this technology and create a new firm. After the recognition of the opportunity to create HRD, a deliberate and systematic search followed in order to further research the market and existing technologies in order to discover how Bernard Smisson's pioneering work could be adapted to suit the needs of the market.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

The opportunity search and recognition process evident in the case of HRD can be divided into two separate developments.

The initial recognition of the opportunity to create HRD can be attributed to entrepreneurial alertness on the part of the founders. Both Lamb and Smisson had previously been working as civil engineers, but had been recently made redundant. The work conducted in their previous work would have given both Lamb and Smisson the necessary skills and knowledge with regards to engineering.

When introduced to the principles that Bernard Smisson had earlier developed, the two entrepreneurs instantly recognised that the technology he had pioneered could have an enormous impact on the British market.

After the recognition of this opportunity, the founders established internal links with both Bernard Smisson, and John Lamb (Tim Lamb's father) in order to begin a deliberate search for the means by which this technology could be used to exploit the opportunity they had recognised.

The decision to bring both into the company Bernard and John supplemented the existing knowledge base significantly as Bernard had a wealth of knowledge that was specific to the needs of HRD and John was an experienced consultant.

The introduction of Bernard Smisson was particularly important, as it was he who understood the workings of the pioneering technology more than any other and was able to assist with its development in creating the company's first product, the 'Storm King'.

Similar to his son, Bernard Smisson was also a civil engineer by trade who had carried out extensive research into hydrodynamic technology while at Bristol University in the 1930's.

Following this he worked for the Bristol Corporation to develop their main drainage division. Here he conceived of and constructed two revolutionary vortex separation chambers which were further studied throughout the 1960's. The results of this research were published in 1967 and were picked up on by the United States Environmental Protection Agency who employed Bernard as a consultant. It was here that he developed many ideas to improve the processes and technologies that he had originally devised, however, due to a lack of funds, these improvements were never incorporated.

It was this extensive knowledge base that led to the initial recognition to create HRD and that greatly assisted the deliberate search for the opportunity to further develop this technology into a product that could satisfy market need.

After an extensive search was conducted using the internal resources that HRD had available to them, they took the decision to further supplement this research by establishing links with

local universities. This was important as it gave the project an external perspective for the first time since the introduction of Bernard and John, and provided further research at a low cost.

Many theorists highlight the importance of gaining a disparate range of information when searching for opportunity as new ideas can seldom be fully developed when they are gained from a single source (Conway and Steward, 1998). In gaining an external source of information and knowledge, HRD were able to avoid the pitfalls of searching for opportunity with an isolated supply of knowledge and skills.

Therefore, through a deliberate search for opportunities to utilise the work of Bernard Smisson, HRD recognised that the hydrodynamic separation technology that Smisson developed could have an enormous impact on the UK market. The entrepreneurs discovered that using this technology they could improve the performance of combined sewer overflows by replacing the traditional devices with an improved device that would increase performance at a reduced cost.

The Role of Networks in the Opportunity Recognition Process

The recognition of the initial opportunity (to develop the technology in order to identify opportunities in the storm and sewage water treatment market) was born out of the link between the company founders, Tim Lamb and Bob Smisson, and Bob's father Bernard Smisson.

Lamb and Smisson were both within the thirty – forty year age bracket and had been made redundant. They had the advantage of knowing the technological research that Bernard had carried out well, thus no real search was required at this stage. However, it was the family network that enabled the founders to have access to the information regarding the technology and allowed for the recognition of the opportunity to take place. This offers a good example of where a social relationship between a group of people can lead to the source of ideas and opportunity recognition.

Once the opportunity to create HRD had been recognised the founders began their search for ways in which they could utilise this technology. It was at this stage that the family network

links that were being utilised became internal ties as the fathers of both he founders were invited to join the firm and assist in the search for exploitable opportunity.

The internal network that was established allowed for the pooling of knowledge and skills and the strength of the ties meant that the communication of ideas was distributed throughout the firm clearly and effectively.

Following the in-house research that HRD conducted, the firm made the decision to create an academic network to assist in their search for ways in which to exploit the opportunity that developing Bernard Smisson's technology offered.

The research departments of the universities were able to carry out further tests on the ideas that were developed by HRD and were also able to act as a proving ground for the technology.

This case study demonstrates the benefits that can be sought by entrepreneurs in the opportunity recognition process through the creation and maintenance of social networks.

6.5 Lloyd Doyle Case Study

Company Background

Two entrepreneurs, Keith Doyle and Roy Lloyd, created the company Lloyd Doyle in 1982 with the intention of creating and producing a new innovation in the field of electronics. The opportunity was to create a machine for optically inspecting printed circuit boards (PCBs) and it was from the recognition of this opportunity that the company Lloyd Doyle was conceived.

Doyle and Lloyd met whilst working together in an electronics company, monitoring and assessing PCBs. Whilst undertaking their work, they discovered a problem with the reliability of the PCBs that was brought to their attention by users. In researching the problem they discovered that the cause lay in the impracticality of trying to assess the boards with the naked eye.

The company whom the pair worked for at the time were manufacturers of PCBs and had little interest in pursuing any research into solving this problem, deciding to let this aspect of the business go to someone with the necessary expertise.

From this Doyle and Lloyd discovered that neither the machine nor the company existed, and were inspired to exploit the opportunity to fill this gap.

The Opportunity Recognition – Deliberate Search or Entrepreneurial Alertness?

Lloyd Doyle was created after the recognition that an opportunity was available to solve the problem faced by many of the users of PCBs. This opportunity was recognised through a combination of entrepreneurial alertness and deliberate search.

The recognition of an opportunity through entrepreneurial alertness, as previously mentioned, is most often a result of the convergence between prior related knowledge and skills with new information and stimuli. In this case, Doyle and Lloyd were both clearly knowledgeable in the electronics field, Doyle possessed technical knowledge and Lloyd had a more commercial bias. When given the stimuli that such a problem existed, and when they searched to solve

the problem and no solution was found, the pair recognised that the opportunity was present to create a new start-up to fill this void.

Once the company was created, the entrepreneurs initiated a deliberate search to find both solutions to the original problem and thus the opportunity to exploit this gap in both technology and in the electronics market.

This task was undertaken by studying the standard tools that were available for image processing at the time. This was then supplemented by an analysis of the market by investigating reports that had been developed by the Department of Trade and Industry (DTI). From this search, it was possible to see that there was a possibility to produce a solution that would be commercially viable.

Following this, Doyle began to further research specific technologies that would be able to solve the problem that was currently faced by users of PCBs. He worked on developing a new technology and was able to produce a prototype to scan finished PCBs.

After producing the prototype version of the product innovation, the Trackscan, an informal network of users was developed in order to test the machine. It was instantly established that the prototype was unable to scan unfinished boards and so Doyle began to modify his product to meet customer requirements that were being developed through the network.

While the innovation was being developed, Lloyd Doyle became frequently active in 'environmental scanning' in order to develop a clearer understanding of market and user trends, new technologies and potential competitors in order to fully understand the market in which they were hoping to enter and to enhance the performance of their innovation.

Therefore it is possible to see how the recognition of the opportunity to produce the Trackscan, from the initial conception of the idea, right through to development and viability testing was a result of both entrepreneurial alertness and deliberate search. The recognition of the gap in the market that was commercially viable was a result of entrepreneurial alertness with the convergence of new knowledge with prior related knowledge, whereas the recognition of the opportunity to produce the particular innovation that became the Trackscan

arose out of a deliberate and purposeful search of the existing technology, the market and user needs.

The Role of Networks in the Opportunity Recognition Process

As with many of the cases studied, the information and resources gained from creating and maintaining a diverse range of networks was very influential in the opportunity recognition process.

The initial opportunity to create Lloyd Doyle was recognised through a user network that had been created whilst working for the PCB manufacturing firm in which Doyle and Lloyd met. It was from this network that the lack of reliability that existed in current products was noted and this provided the entrepreneurs with the impetus to create their own firm in order to solve this problem and satisfy a market niche.

Once the company had been established and the pair were actively researching and scanning for opportunities the user networks that they had established proved to be beneficial again. On this occasion the networks were utilised in order to gain opinion and feedback on the prototype that Doyle had developed. Many studies have highlighted the merits of involving user groups in the innovation process (von Hippel, 1977, 1988, 1993). Lloyd Doyle was able to use these networks in order to gain invaluable information in their search.

Lloyd Doyle also established external networks with ex-colleagues at the PCB firm they left to set up the new company. From this network, involving a mixture of both formal and informal ties, they were able to draw upon the expertise of professionals that were working within the industry that their innovation was to supply. This gave them access to specialist ideas, information and expertise.

Having studied for a PhD at Cambridge University, Keith Doyle was also able to draw upon an academic network in order to supplement his own knowledge whilst conducting 'environmental scanning' for information regarding electrical technology and design viability.

The access to information and resources that were gained in establishing these networks of relationships was further supplemented by the creation of a scientific network established through meetings at trade shows and exhibitions. The type of information that is often gathered through such weak links often supplements existing knowledge, ideas and information and often provides a good opportunity to test the viability and potential acceptance of an innovation such as the Trackscan.

In conclusion, the networks that were established and maintained by Keith Doyle and Roy Lloyd were essential in the opportunity recognition process. Perhaps most important were the informal ties that were established with PCB users. Without this link, the recognition of the problem that led to the creation of Lloyd Doyle may have gone unnoticed, and the pair would not have had access to the useful insights that supplemented their search for opportunities to solve the problems that had been highlighted.

In conclusion, it is evident that the process of deliberate search that was conducted by Lloyd Doyle was greatly assisted by the resources that were gained through utilising networks, both formal and informal with the external environment. The information gained from the DTI, the scientific network, the academic network and the professional network shows how the development of a disparate array of networks can heavily supplement the skills and know-how that are present within the firm. This also demonstrates an example of what Granovetter (1973) describes as the 'strength of weak ties'.

6.6 Key Issues from the Analysis of the Case Studies

Interestingly, in all of the cases examined an analogous pattern emerged in that the initial recognition of an opportunity was identified by the entrepreneur(s) displaying characteristics of entrepreneurial alertness, and this was then followed by a deliberate search in order to fully explore the opportunity. For example in one case, through means of entrepreneurial alertness the entrepreneur was able to recognise the potential opportunities that were being opened up in the developing PC market. He was able to recognise this due to his expertise and prior knowledge of the market being supplemented by new knowledge of shifting market trends. However, he then supplemented this by conducting a deliberate search into the ways in which he could redesign the package by which consumers receive PCs and the specifications of the products he was providing.

This was a common trait in all of the cases – the initial opportunity was recognised by means of entrepreneurial alertness. This initial discovery uncovered an imprecise opportunity that was emerging in a particular industry. The entrepreneur(s) then supplemented this by embarking upon a deliberate search in order to explore the environment fully for specific entrepreneurial opportunity (see table below).

Table 9 – Table Demonstrating the use of both Entrepreneurial Alertness and Deliberate Search in the Opportunity Recognition Process

Company	*Example*
Elonex	The entrepreneur recognised the potential of the PC market through means of entrepreneurial alertness. The prior related knowledge was gained through both working in the import-export business in Taiwan, giving him knowledge of the ins and outs of exporting from Taiwan (costs, regulations, time expectations etc), and from having worked as a PC dealer in Taiwan, he would have had an in depth knowledge of the market and consumer. These knowledge sources, when combined with the types of stimuli Wetrin was exposed to in researching information on PCs for his new business venture led to the recognition the opportunity to enhance the service and product offering in the PC mail order industry. After this initial opportunity was identified, he conducted a deliberate search to more specifically explore ways in which he could innovate within this industry. The deliberate search involved conducting R&D into the market and consumer trends, and the current distribution channels and service offerings currently available. From this, the opportunity to provide both mail order PCs at a cheaper cost (by importing generic PCs from Taiwan) and to address the concern that the increasing pace of

	technological developments in the PC market was beginning to lead to newly bought and existing PCs becoming obsolete with increasing rapidity (by producing easily PCs compatible with new processor cards which can easily upgrade the PCs performance).
Hydro Research and Development	Both of the entrepreneurs who established HRD were previously in employment as civil engineers. This employment gave the founders the in-depth knowledge base of drainage and sewerage industry. However when exposed to the new knowledge (revolutionary plans for a drainage system drawn up by one of the entrepreneurs father several decades earlier) the opportunity to produce new products for the drainage market was recognised. This was then followed by a deliberate search for ways in which the pioneering drainage system plans could be adapted and applied to products in the modern market by exploring the market and products currently available. The original plans were developed to form a marketable product suitable for the British market.
Hydraroll	Similarly, in this case the entrepreneur recognised the existence of a source of opportunities in the cargo/dock loading market through entrepreneurial alertness. The entrepreneur worked in the Navy, looking to find solutions to their loading mechanisms in their dock loading system. This knowledge was then supplemented by inputs from a user network established by the Navy to highlight problems and discuss solutions. The converging of this knowledge allowed for the recognition of the opportunity to produce new products in this industry as there existed problems which were yet to be addressed by any other firm. After identifying this initial opportunity, the entrepreneur instigated a deliberate search in order to discover specific opportunities in which to utilize the innovative cargo loading solutions he had uncovered while working for the Navy.
Lloyd Doyle	During their employment in an electronics company, the founder entrepreneurs developed working technical and commercial knowledge of electronics and printed circuit boards (PCBs). When a process need was first brought to their attention through a user network, however, after being exposed to this stimuli, the entrepreneurs recognised that there were niches in the PCB market that were yet to be exploited. Following this discovery, they established Lloyd Doyle and initiated a deliberate search to find solutions to the problems that they encountered in their previous employment and ways in which the solutions could be used to exploit gaps in both the technology and the electronics market.

In light of this pattern, it is apparent that neither of the two influences was particularly dominant over the other. In fact, the way in which the opportunity recognition process evolved in these cases demonstrates that the identification of the opportunities may not have been possible had only one influence been apparent i.e. the initial recognition would not have been possible without the individual(s) displaying entrepreneurial alertness and the specific opportunity would not have been recognised had this not been followed up with a deliberate search.

In all four of the cases that were explored, it is evident that many of the characteristics that were evident in the process of opportunity recognition through entrepreneurial alertness that was earlier outlined are evident here.

- The pattern of prior related knowledge + complementary new knowledge = entrepreneurial conjecture was evident,
- The opportunity was always related to area of expertise,
- Prior knowledge was built up through work experiences,
- The new knowledge was often related to the area in which the entrepreneur(s) had an interest.

This was also apparent with regards to the deliberate search that was carried out in each of the cases. In the cases examined the search was:

- Often carried out by a team,
- Related to the entrepreneur(s) knowledge, skills and competencies,
- Supplemented by experience gained from previous employment,
- Specific to particular products and industry segments.

From the analysis of the cases it was possible to see that there were a number of common characteristics apparent in each of the opportunity recognition processes examined. The cases all followed a similar framework in that they involved the recognition of the basis of an opportunity through entrepreneurial alertness. In all instances the ways in which the opportunity was identified mirrored the common characteristics of opportunity recognition through entrepreneurial alertness that were earlier highlighted. After this initial awareness of

the opportunity, a deliberate search was conducted with more specific opportunities becoming apparent as a result of this. Similarly, the characteristics of a successful deliberate search as highlighted earlier were also evident in these cases.

This is interesting as it highlights that these influences upon opportunity recognition are not necessarily mutually exclusive and in all of the cases examined seem to share a number of similar characteristics and follow similar patterns. This finding has a number of important implications, as discussed in the following chapter.

Chapter 7 - Implications and Discussion

7.1 Introduction to Discussion

The exploration of the opportunity recognition process in the 49 cases demonstrates the behaviours, characteristics and influences that were apparent in the successful recognition of an opportunity. Therefore, by studying these cases, it is possible to assess the implications that are apparent for those entrepreneurs who themselves are endeavouring to recognise opportunities for innovation.

As discussed, it is important to consider the difference between *recognising* opportunity and *exploiting* opportunity. This study is only concerned with the factors that influenced the recognition of opportunity, not the ways in which the entrepreneurs exploited the opportunity to successfully create profit or value.

The research analysed opportunity recognition in terms of *how* opportunity was recognised. A framework was devised by examining opportunity recognition in terms of deliberate search and entrepreneurial alertness. With regards to all of the cases, the role played by networking in the opportunity recognition process is investigated in terms of how the gains made by networking can facilitate the successful identification of an opportunity, and the types of network relationships that are the most advantageous to this process.

7.2 The Impact of Deliberate Search on the Opportunity Recognition Process

Theory concerning entrepreneurial opportunity has been more traditionally concerned with ways in which the entrepreneur can actively search for opportunity in specific areas of their business and social environment. Through the analysis of the research it was apparent that a number of the case studies exhibited deliberate search as having a positive impact upon the opportunity recognition process. This would imply that by deliberately searching for opportunity, it is possible that the entrepreneur is likely to improve the likelihood of successfully recognising entrepreneurial opportunity. However, the case study analysis has shown that there are a number of common characteristics evident and a number of important issues and implications to be addressed.

Theory relating to the concept of opportunity search suggests that the exploration of certain specific areas is likely to yield a number of profitable opportunities. The case studies showed that although the opportunity was discovered within the particular areas as outlined in Drucker's framework, there are a number of important considerations to be made.

Firstly, a common characteristic of the case studies showed that the opportunity search was always conducted within one particular area of interest. In none of the cases did the entrepreneur blindly search into a number of different industries, markets or products of which they had no prior knowledge. This is a key consideration as it highlights the importance of knowledge as noted by Wickham (2000), Cohen and Levinthal (1990) and Trott (1998). The entrepreneur already had experience, skills and a level of in-depth knowledge in the area of interest before the search was embarked upon.

Another important issue related to this is that the search was rarely conducted by one individual alone. The search was performed either by a group of individuals looking to start a new venture or by a research/project team, assembled by the founder entrepreneur. This underlines the importance of diverse and complementary knowledge in the process of deliberate search as in each of the cases the pooling of knowledge was fundamental to the search process.

The analysis of the case studies highlights the importance of knowledge accumulation and the effective assimilation and application of new knowledge gained from the search in this process of identifying an opportunity. This finding relates to the discussion of 'the entrepreneur' that contests the notion of entrepreneurship being some innate capability or trait (Drucker, 1985; Christensen, Madsen and Peterson, 1994; Wickham, 2000; Robert, 1993). It also highlights the important role played by knowledge and experience in this process. The discovery of opportunity by deliberate search in these case studies demonstrates that opportunity recognition is not necessarily the result of an individuals innate entrepreneurial abilities or personality traits, but the result of knowledge accumulation and assimilation, hard work and the wherewithal to search and monitor certain areas with 'diligence and regularity' (Robert, 1993).

The implication of this is that having prior related knowledge in the search area is essential to the effective recognition of an opportunity. The research shows that opportunity cannot

merely be searched for and discovered in any area. Entrepreneurs wishing to search for opportunity must have some prior knowledge and expertise in this area and must also be willing to complement and supplement this knowledge base by establishing a project or research team and by seeking assistance from others. The Internet retail boom of the late 1990's provides a good example of this. Those individuals who wanted to conduct a deliberate search into this would be unlikely to experience any success if they possessed neither an in-depth knowledge of retailing, or of the software, hardware, industry norms and consumer patterns concerning the Internet and Internet retail.

Another common characteristic apparent in the case studies was that the knowledge, skills and expertise gained whilst in previous employment often triggered the search. In other words, the knowledge gained from work experiences gave the entrepreneurs a solid grounding from which to begin the search. The research demonstrated that by working in the particular industry or with the particular products around which the search was conducted, the entrepreneur had accumulated an in-depth knowledge of this area in terms of any potential problems, market trends, consumer trends, potential changes etc. The experience gained from their role in previous employment often resulted in the entrepreneur having some experience of a *user* background in the industry, which enabled further insights in the deliberate search for opportunity.

Through studying the nature of the opportunity that was recognised by means of deliberate search, a further conclusion can be drawn. In many of the case studies analysed, the opportunity recognised was often an incremental innovation that was based upon a *process need*. As proposed by Drucker (1985), a process need 'perfects a process that already exists, replaces a link that is weak, redesigns an existing process...supplying the missing link'. This would appear to follow the suggestion that the successful deliberate searches were conducted in a specific manner with specific markets, products and processes in mind and was rarely conducted broadly across industries or populations.

Theory regarding the search for entrepreneurial opportunity also discusses *change* as one of the most important elements to be monitored (Drucker, 1985; Wickham, 2000; Robert, 1993; Tidd, Bessant and Pavitt, 2001). The analysis of the case studies also found this to be one of the common traits in the successful search for opportunity. Many of the case studies displayed examples of how the monitoring of change revealed exploitable opportunity.

From examining the theory regarding the deliberate search for opportunity and the case studies that demonstrated characteristics of a deliberate search it is possible to draw a number of conclusions as to the common characteristics of a successful search.

The examination of the case studies showed characteristics that were closely related to many of the important recommendations that are highlighted within this body of theory.

- Firstly, the cases provided evidence to suggest that by searching in particular areas in the business environment it was possible to identify entrepreneurial opportunities. However, the research also shows that the recognition of opportunity via this means is not necessarily as simple as it may sound. Entrepreneurs cannot simply search for and find opportunity as the successful searches were characterised by a number of variables, the most important of these being prior knowledge.
- In not one of the cases examined did the entrepreneur(s) search within an environment of which they had no previous experience. The search behaviour was characterised by having an in-depth level of knowledge, skills and experience from within the area that the search was being conducted.
- From this analysis, the prerequisite of having prior related knowledge was further highlighted by the fact that in no case was the search conducted independently. Either the decision to search for opportunity was made by a group of entrepreneurs, or the individual created a design or research team, employed specialists or enlisted assistance through networking in order to supplement their existing knowledge base.
- Another common characteristic that was apparent in the vast majority of the cases that demonstrated deliberate search in the opportunity recognition process was that of the role played by the entrepreneurs past employment. In many of the cases, the deliberate search began while the entrepreneur was still working for their previous employers, yet when the firm refused to capitalise on the opportunities were being discovered, the entrepreneur left their position in order to establish their own company with the view to further search and discover exploitable entrepreneurial opportunity.
- The fifth characteristic commonly apparent in the cases is that *change* was an important element in the search for new opportunity. In the majority of the cases that

showed deliberate search as having a positive impact on the opportunity recognition process, the opportunity arose as a result of some change in the business environment. The cases showed changes in market structures, changes in perception and changes in demographics as being profitable for new opportunity.

7.3 The Role of Entrepreneurial Alertness in the Opportunity Recognition Process

The body of theory concerning entrepreneurial alertness is centred upon the role played by cognitive processes in the identification of entrepreneurial opportunity and the examination as to why some people recognise opportunity where others do not.

As previously discussed, this body of theory is more concerned with the way in which those entrepreneurs who successfully identify opportunities are able to coordinate knowledge, identify novel linkages between information and when presented with certain inputs are able to recognise new means end relationships.

In order to draw lessons from the analysis of the cases exhibiting entrepreneurial alertness, it is important to investigate the common behaviours and characteristics of these cases. Through this analysis it is possible to draw a number of conclusions based upon these common characteristics and behaviours apparent in the cases showing the successful recognition of an opportunity.

The first important finding from the research was that in the vast majority of the cases the opportunity was recognised through the pattern of:

> *New knowledge is received that is complementary to some prior related knowledge and this leads to an entrepreneurial conjecture with the recognition of an opportunity as the output.*

This finding supports the framework discussed earlier regarding the process of opportunity recognition through entrepreneurial alertness. Again this highlights the importance of knowledge in this process and stimulates the debate as to why some people recognise opportunities and others do not.

Much of the theory regarding this debate refers to the individual's cognitive processes. This affects the ability of the individual to coordinate knowledge and structure information in order to assimilate it effectively and thus recognise opportunity.

The exploration of the case studies highlighted that although the cognitive differences may impact upon an individual's ability to identify an opportunity, behavioural and knowledge differences are also important.

As seen in the case study analysis, the entrepreneurs were able to recognise opportunities in areas of which they had already built or gained an extensive knowledge base. This knowledge base was then further supplemented by the entrepreneur's networking behaviours and their active interest in this area. What is important here is that in the cases showing the successful recognition of an opportunity, the entrepreneur possessed an in-depth knowledge base in the subject area and this was continually supplemented with new knowledge.

The research shows that the difference between individuals who recognise opportunities and those who do not may be based as much in behavioural explanations as in explanations centred on some innate ability. The case studies highlight examples of where those entrepreneurs who are able to effectively accumulate and assimilate knowledge and who actively absorb themselves in the area of interest are likely to be able to recognise novel linkages and new means-end relationships when exposed to new and related stimuli.

Thus, from the analysis it is possible to conclude that those entrepreneurs who actively seek to infuse themselves with knowledge regarding the area of interest are more equipped to be able to recognise emerging opportunities. As the density and diversity of the entrepreneur's 'stock' of knowledge is increased, so is the entrepreneur's 'schema' for opportunity identification. By this it is understood that as the entrepreneur receives new stimuli, the larger and more diverse the knowledge base becomes and thus the more likely it is that the entrepreneur will be able to relate the new knowledge with some aspect of their prior related knowledge leading to the identification of an opportunity.

This cannot contest the innate abilities of different individuals ability to organise and utilise knowledge. However, the analysis suggests that the concept of entrepreneurial alertness is not restricted to certain individuals who are born with these abilities. Those individuals who

seek to infuse themselves with knowledge and who actively attempt to absorb themselves in their area of interest will improve their chances of recognising new means-end relationships when exposed to new stimuli.

Therefore the debate as to why some individuals recognise opportunities whereas others do not can be accounted for by behavioural explanations, knowledge differences and cognition in terms of the ways in which they actively accumulate and assimilate knowledge. As proposed by Shane and Venkataraman (1997), no two people share all of the same information and skills at any one time, and this clarifies why the information required to identify a particular opportunity at a particular time is not widely distributed among the population. The entrepreneur who endeavours to expand their knowledge base and be open to new knowledge inputs is likely to increase their prospects of identifying new opportunities by converging prior and new inputs.

Another important conclusion to be drawn from this finding relates to the types of prior and new knowledge that were commonly important in the opportunity identification process.

The prior knowledge that the entrepreneurs had amassed and supplemented was always related to the area in which the opportunity was discovered often through work or career experiences. This would again highlight the significance of knowledge accumulation in the opportunity recognition process, as the cases demonstrate that in no instance did the entrepreneur identify an opportunity that was completely unrelated to their area of interest.

Similarly, the new knowledge or stimuli that triggered the entrepreneurial conjecture was related to the prior knowledge at least indirectly. This is another important issue in the above debate as it shows that even if an innate cognitive ability was present in the entrepreneurs, none of the opportunities were identified in a completely unrelated area. In other words, no matter how effective the cognitive skills of the entrepreneur, in no case did the individual simply pluck opportunities out of thin air.

Within the body of theory surrounding entrepreneurial behaviour, there is a great deal of attention paid to the role of *luck* and *chance* in the process of entrepreneurship. In many of the case studies examining the role of entrepreneurial alertness in the opportunity recognition process, the route of:

prior related knowledge + complementary new knowledge = entrepreneurial conjecture

was followed. The source of the complementary new knowledge, information or other stimuli that triggered the entrepreneurial conjecture was often some chance comment, action or behaviour. This would seem to suggest that chance or luck has played some part in the process of opportunity recognition.

However, further analysis of the case studies shows that the 'luck' that the entrepreneurs have experienced is largely of their own making. By actively and consistently infusing themselves with information, knowledge and skills regarding the area of interest, the entrepreneurs open themselves up to new stimuli and are responsible for the new inputs that they receive. In this respect, the role played by luck or being 'in the right place at the right time' is contested, as the entrepreneur consistently put themselves in the right place in order to be able to recognise emerging opportunities as through these behaviour patterns they continually receive the diverse and disparate stimuli required. This also suggests, as discussed, that entrepreneurial alertness may not be as clear cut as simply suggesting some people possess an innate ability to be able to recognise opportunities through cognition and heuristics and others do not. It suggests that by engaging in certain activities, actions and behaviours, the entrepreneur may increase the likelihood of recognising opportunity through entrepreneurial alertness.

The examination of the case studies highlighting entrepreneurial alertness as the dominant influence show a number of common characteristics that should be considered:

- A prior knowledge base is essential in the opportunity recognition process. This prior knowledge should be continually supplemented through the accumulation and assimilation of new knowledge in this area of interest.
- This creation of a diverse and extensive knowledge base will increase the likelihood of new opportunity recognition as when novel and unique inputs are received, there is more chance of the entrepreneur being able to link this with their prior knowledge and identify a novel linkage or means-end relationship.

- The opportunity identification through entrepreneurial alertness is not contingent upon an innate ability. The behaviour patterns and knowledge accumulation of the entrepreneur are just as important in the identification of an opportunity.
- The activities that led to the accumulation of prior knowledge were common in most cases. The analysis found that the prior knowledge that the entrepreneur had gained had been built up largely through work experiences.
- New knowledge, especially the unique and novel information that triggered the entrepreneurial conjecture was occasionally received in a chance situation. However, the analysis has shown that in most cases, by actively immersing themselves in the area of interest, the entrepreneurs regularly put themselves in the correct position by which they would regularly receive novel information and knowledge – by consistently putting themselves in 'the right place' the entrepreneur was regularly positioned to receive the right information at 'the right time'.

7.4 How Networks Facilitated the Opportunity Recognition Process

From the analysis of the case studies highlighting the successful recognition of entrepreneurial opportunity, it was evident that through networking activities the entrepreneur was able to supplement their resources in a manner that positively impacted upon the opportunity recognition process. In some cases, the analysis showed that the influences upon which the opportunity recognition was contingent could not have been accessed or gained had the entrepreneur not have been active in creating and maintaining an entrepreneurial network of relationships.

As discussed past research has shown that by networking, entrepreneurs can gain access to resources such as new knowledge, information, skills, technologies and capital. Although this past research has more traditionally focused upon networks in terms of supplementing the entrepreneur's scarce resources post the start-up of a new venture, the case study analysis shows that these gains can also be instrumental in the opportunity recognition process.

The main influence that networking played in the successful identification of opportunities in the case studies, was the generation of new and diverse knowledge. By creating and

maintaining diverse networks of relationships, the entrepreneurs were able to augment their knowledge base, which increased the likelihood of identifying opportunities through both deliberate search and entrepreneurial alertness.

With regards to entrepreneurial alertness, the creation and maintenance of networks was invaluable to the recognition of opportunity in many of the case studies. Although the analysis shows that the creation of networks was less intense than in the deliberate search cases, the network links that were established provided the entrepreneur with significant inputs that had a positive effect on the identification of the opportunity.

In a broad sense, the links were able to supplement the entrepreneur's foundation of prior knowledge. By creating links with academic bodies, past employers, work mates, family friends and users the entrepreneurs were able to augment their existing knowledge, and as discussed above, become absorbed in their area of interest.

These relationships were also significant in that they increased the chance of the entrepreneur being exposed to unique stimuli, enhancing the possibility of a novel link or new means-end relationship being identified. The case study analysis provided support for the theory stating that effective networks should be as 'complex and as heterogeneous as the daily activities of the venture' (Johanisson and Peterson, 1984). Those entrepreneurs who sought to establish a variety of strong, weak, formal and informal ties were able to develop a rich and diverse knowledge base.

The unique and disparate knowledge gained from weak or informal ties was often the most important information in the opportunity recognition process. These links were regularly the source of the stimuli that when related to prior knowledge allowed the entrepreneur to recognise a novel linkage or new means-end relationship. This also supports the claim that 'behind every formal network, giving it the breath of life, are usually various informal networks' (Freeman, 1991). Past research has also suggested that although strong ties offer the entrepreneur more frequent exchanges, the potentially more important and unique information are exchanged during heterophilous (weak ties) interactions (Rogers and Shoemaker, 1972). This was apparent in many of the case studies analysed.

In the cases displaying deliberate search as the main influence upon the opportunity recognition process, the use of networks was valuable in that they also provided access to resources that supplemented the search. Not only did the network relationships supplement the knowledge base of the research team, but also links established with venture capitalists and investors provided the entrepreneurs with the resources to be able to augment their own internal R&D.

In these cases, there were certain types of networks that appeared to be more advantageous than others. The analysis showed that user networks were of particular importance to those firms seeking opportunity by means of a deliberate search. As the investigation has shown, incremental and process need innovations were regularly recognised through this method of opportunity identification. The analysis shows that central to the identification of an incremental or process need innovation is the successful recognition of both problems and solutions in the given industry or market. In analysing the role of users in the innovation process, von Hippel (1993) has identified that users can often contribute to this process by both perceiving the need for a solution and in the conceiving of a solution.

The previous analysis has also discussed the notion that in none of the cases was did one individual alone conduct the deliberate search. If the founder entrepreneur established the venture alone, the cases show that a design or research team is created in order to supplement the capabilities of the founder.

In these cases, the role that is played by internal networks is vital to the opportunity recognition process. Communication flows, both internal and external are an essential element in the opportunity recognition process as seen in the case studies analysed. This analysis revealed that by maximising the flow of information and knowledge through open communications a more creative environment was harboured and this increased chance of an opportunity being identified. These internal networks were able to allow for the knowledge that was held by the individual members of the group and the knowledge that was gained through networking and search activities to be successfully assimilated and disseminated throughout the project team. In many of the cases this was supported by one or more of the members assuming boundary spanning roles in order to ensure that the knowledge and information flows gained externally were absorbed, translated into formats that were easily understandable and communicated throughout the team.

Through the case study analysis it was possible to conclude that the creation of both internal and external networks can positively affect the opportunity recognition process. Networking activities promoted the flow of diverse information into and within the company and helped to both build up a comprehensive knowledge base and provide the stimuli that led to the recognition of a new opportunity.

A number of different networks were apparent in the case studies, all of which provided the entrepreneurs with access to resources that assisted in the opportunity recognition process. However, there were some relationships that were more effective than others. The types of links that were the most beneficial to the entrepreneur depended upon the area in which the interest lay. For example, user networks were of particular benefit to those entrepreneurs seeking to uncover opportunities with regards to technology push innovations as the information gained from these relationships allowed the entrepreneur to gauge how new technologies were likely to be accepted by particular user groups. User networks were also important in providing effective guidance for the direction of the search and research conducted. With regards to the individual entrepreneurs who recognised opportunity through entrepreneurial alertness the most beneficial relationships were often those with academic institutions. These relationships were important as they provided the individual with access to large amounts of information and research regarding the area of interest that the entrepreneur would not normally have been able to amass single-handedly.

The role that is played by luck or being 'in the right place at the right time' is again contested through the analysis of the role played by networks in the opportunity recognition process. Through networking activities the entrepreneurs frequently put themselves in the 'right place' so that when the 'right time' emerges, they are able to utilise the knowledge effectively in the opportunity recognition process.

It is important to consider that although certain networks were more advantageous than others were, in not one of the cases did the creation of a network provide the entrepreneur(s) with no benefit at all.

7.5 Deliberate Search and Entrepreneurial Alertness – Mutually Exclusive or Mutually Dependent?

Prior research and theory surrounding these two mechanisms, earlier discussed in relation to the propositions made by Drucker (1985) and Kirzner (1979), regards the two mechanisms as separate entities. An interesting finding from the research study relates to the degree to which these two mechanisms are complementary to one another.

From the analysis of the research it is apparent that in many respects these two mechanisms may not be as mutually exclusive as prior theory has suggested. The research study has found that a number of the activities displayed by the entrepreneurs in instances of both deliberate search and entrepreneurial alertness would have a positive impact upon the opportunity recognition process regardless of the mechanism most dominant. For example, the knowledge and information gained during a deliberate search could also be significant in identifying opportunities through entrepreneurial alertness and vice versa.

In fact, one of the most interesting findings of the case study analysis was the number of cases that demonstrated both entrepreneurial alertness and deliberate search in process of opportunity recognition. This analysis highlighted the possibility that these two mechanisms of opportunity identification should not be treated as mutually exclusive, and those entrepreneurs aiming to recognise new opportunities can learn from the conclusions drawn from the analysis of both of these mechanisms.

The analysis highlights how the successful recognition of an opportunity in a number of the cases was due to the converging of both entrepreneurial alertness and deliberate search. In each of the cases analysed, the pattern followed that the recognition of the initial opportunity, or the recognition of the basis of an opportunity was through entrepreneurial alertness. Once this had been achieved, the entrepreneur(s) followed this by embarking upon a deliberate search for more specific information regarding the area of interest.

The most important similarity between these two cases is the necessity for both a solid foundation of prior knowledge, and the active accumulation of new knowledge in order to supplement this knowledge base. In none of the case studies was an opportunity recognised in an unrelated area of which the entrepreneur had no prior interest.

The similarities surrounding the role of knowledge, prior and new, the role of networks and the congruent roles of the two mechanisms highlights that those entrepreneurs who are looking to uncover new opportunities should look to instigate the behaviour patterns and processes that are pivotal to both deliberate search *and* entrepreneurial alertness. This is based upon the research findings that suggest that the benefits of both entrepreneurial alertness and deliberate search can positively influence the opportunity recognition process in a complementary manner.

In gaining an understanding of the role that is played by networking activities in facilitating the process of opportunity identification it is possible to consider another way in which deliberate search and entrepreneurial alertness may be convergent. From the analysis of the case studies, it is apparent that the networking activities were similar in all of the case studies. That is, there were no dominant features in the searches showing deliberate search cases that were not apparent in that showing entrepreneurial alertness.

The gains made from the networks, however, did affect the opportunity recognition process in different ways. There were benefits that were better suited to the process of deliberate search and benefits that were better suited to the knowledge and inputs required with regards to entrepreneurial alertness. However, rather than suggesting that the entrepreneur should aim to establish different network linkages dependant upon the mechanism of opportunity identification, the research suggests that the gains made through social networks can impact both of these mechanisms in a complementary manner. Put simply, the gains made from networking could be amplified if both of these mechanisms were used in conjunction, as the types of inputs gained would mutually benefit both mechanisms in a simultaneous manner.

Another important finding was that the exploration of the case studies demonstrating entrepreneurial alertness as the dominant influence in the opportunity recognition process showed that the opportunity that had been identified fitted into Drucker's framework of the 'Seven Sources of Innovative Opportunity' in each case. This finding supports the propositions as made by Drucker, Robert, Wickham *et al* that opportunity can be found in specific areas, as even in the cases where the opportunity was not deliberately or actively searched for, it still fell into one of the areas that Drucker outlined. This would again

suggest a degree of complementarity between the two mechanisms in that in all of the case studies the opportunity fell into Drucker's framework

The theory surrounding Drucker and Kirzner would suggest that the two mechanisms, entrepreneurial alertness and deliberate search, are separate in that opportunities are recognised through one or the other. Although the opportunity recognition process can be supplemented and improved by exhibiting one of these mechanisms, the case study analysis has found that there is evidence to suggest that these are not necessarily mutually exclusive. The opportunity recognition process can also be facilitated by a convergence of these mechanisms and the lessons drawn from their analysis.

This finding supports the proposals made by Christensen, Madsen and Peterson (1994) as earlier discussed. They proposed that although scanning techniques and deliberate search methods do contribute significantly to the opportunity recognition process, they do not offer a complete explanation. They argue that behavioural explanations are just as important, describing entrepreneurial behaviour as a learned management behaviour, not an innate ability or personality trait.

8.1 Conclusion

The findings of the case study analysis clearly offers support for the suggestions that through deliberate search and entrepreneurial alertness individuals can increase the likelihood of successfully identifying new entrepreneurial opportunity. However, the research has also uncovered evidence to suggest that these mechanisms are not necessarily as exclusive from one another as prior research had suggested.

Through the exploration of the case studies, a number of conclusions can be drawn regarding both deliberate search and entrepreneurial alertness and the actions and behaviours exhibited by those entrepreneurs who have successfully identified new entrepreneurial opportunities.

One of the most important conclusions to be drawn regarding the opportunity recognition process is that of knowledge accumulation, assimilation and dissemination. The research highlights this as the most important variable in the opportunity recognition process through both deliberate search and entrepreneurial alertness. The cognitive behaviour of the entrepreneur in absorbing and coordinating knowledge is essential to the opportunity recognition process.

The research also adds to the debate as to why some people are able to recognise opportunity and others are not. Past research has attributed this to an innate ability, however, although it would be premature to speculate that there are no innate differences between individuals that can affect the opportunity recognition process, there may be a behavioural explanation. The research has found that by consistently accumulating knowledge and through networking activities, the entrepreneur can increase the likelihood of an entrepreneurial conjecture resulting in the identification of an opportunity. As suggested by Shane and Venkataraman (1997), opportunity identification is based upon cognitive, behavioural and knowledge differences.

The case study analysis concerning deliberate search highlights the importance of bringing in and utilising as many different knowledge inputs as possible. The cases showed that the effective creation of a research/project team is important in achieving this. The networking

activities demonstrated in these cases also illustrated this point. The relationships that were of most benefit to the entrepreneurs undertaking a deliberate search were those with users, academic bodies and ex-colleagues who were able to provide new and diverse knowledge inputs.

These cases also highlighted the importance of change. Prior research has suggested that by monitoring change in the business environment entrepreneurs are likely to be presented with a wealth of opportunities. The research study provides support for this proposition in that a number of the opportunities recognised in the case studies were apparent due to changes in perception, industry structures, demographics etc

With regards to entrepreneurial alertness, the research has shown that the process of when prior related knowledge is supplemented by some new, related stimuli an entrepreneurial conjecture results in the recognition of an opportunity is a common characteristic. Through the analysis of the case studies, the importance of knowledge accumulation and coordination has been highlighted.

The analysis has accentuated the different types of knowledge that are beneficial to this process and the behaviours that are useful in acquiring such knowledge. By immersing themselves in the area of interest and by utilising networks to gain access to complex, diverse and unique knowledge, skills and information, the entrepreneur can develop their 'stock' of information, which increases the likelihood of the identification of a new opportunity.

The research study has found that the networking activities undertaken by the entrepreneurs had an immensely positive impact upon the opportunity recognition process in cases of both deliberate search and entrepreneurial alertness. The types of benefits that the entrepreneurs gained were often essential in that they provided both depth to existing knowledge and in many cases provided the unique and novel information that led directly to the identification of the opportunity.

An important finding from this research has been the complementarity between the two mechanisms, suggesting that the processes involved in both deliberate search and entrepreneurial alertness can be used together in the successful recognition of an opportunity.

The research study suggests that the two mechanisms should not be considered as exclusive from one another. Through the examination of the common characteristics, behaviour patterns, knowledge and information gains and the criteria required to identify opportunity through these mechanisms it may be considered that deliberate search and entrepreneurial alertness are two polarities of a single framework for opportunity recognition.

This framework suggests that entrepreneurial alertness and deliberate search are similar in that both of these mechanisms are contingent upon the cognitive mechanisms that refer to knowledge accumulation and coordination. Although the means of knowledge accumulation are not always similar, the opportunity recognition process within both deliberate search and entrepreneurial alertness is reliant upon the entrepreneur(s) possessing and supplementing an extensive knowledge base within a particular industry/market/product or area of interest.

These mechanisms are then supported and facilitated by similar behavioural patterns that involve the creation and maintenance of social networks. The knowledge accumulation process in each of the cases is underpinned by the behavioural actions of the entrepreneur, which are embedded within these social networks.

As noted by Christensen, Madsen and Peterson (1994), opportunity recognition can be contingent upon change, scanning and problem solving, however, equally important are knowledge accumulation, learning, strategic thinking and networking.

Therefore, in consideration of the complementarity between the two mechanisms and the mutually beneficial gains that can be sought through the creation of social networks, it is apparent that those entrepreneurs who aim to identify new opportunity can learn from the mechanisms of both entrepreneurial alertness and deliberate search and the pivotal role played by the successful accumulation and assimilation of knowledge.

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Appendix 1 - Table Outlining the Nature of the Innovation in each Case Study

COMPANY	YEAR	DS, EA OR BOTH	NATURE OF INNOVATION
Conveyors International Ltd	1982	Deliberate Search	Developed a new product to replace industry standard in the materials/mechanical handling industry. Analysed existing products in terms of performance and through deliberate search devised a way in which performance as well as cost effectiveness, product life and increased capacities could be improved.
Distributed Information Processing	1986	Deliberate Search	The three founders recognised the wealth of opportunities that existed within the market of computer based systems and thus created a company with the intention of searching for, and exploiting an opportunity to satisfy a niche market. Through deliberate search DIP recognised the opportunity to produce the pocket PC and captured a niche market with first mover advantages.
Gems of Cambridge Ltd	1983	Deliberate Search	Gems of Cambridge Limited (GOCL) was a new technology based firm that was established after a government computer aided design centre (CADC) project was disbanded. The company produced the Gemsys 35, an incremental innovation on a past product and they became the largest supplier of digital image processing systems in the UK.
Terence Piper Company	1977	Deliberate Search	After an extensive search within the vending machine industry, the founder recognised the change in perception to food and drink culture with health becoming more important than before. Through the Freshbrew range, TPC provided drinks vending machines with healthy alternatives and thus captured a mass market on the back of a competitive advantage that many competitors had failed to realise.
Highbrave Ltd	1983	Deliberate Search	While working for a Quantity Surveyor, the founder developed an idea to produce a software package that replaced previously manual methods of measurement. Through an evaluation of the computer market that could assist with this work, no such product was identified. Therefore, the founder conducted a deliberate search for ways in which this problem could be solved. The outcome was Calculix, the first software based measurement system for surveyors.
Autographics	1979	Deliberate Search	Autographics was committed to in-house R&D in their production of CAD software for the educational sector. Through a deliberate and systematic search of this sector,

			they recognised the opportunity to create an entirely new market sector for themselves in producing the Compas Designer – the first micro-CAD system tailored to the educational sector. This coupled a new technical capability (microcomputers) with a customer need (CAD software to train students).
CFM Metal Fax Ltd	1981	Deliberate Search	Manufactured microlight aircraft filling market gap after the granting of 'air worthiness' to microlights in many countries around Europe. Through deliberate search the founder discovered an opportunity to provide highly specialised manufacturing to a niche market.
Cal Gavin Ltd	1980	Deliberate Search	Continual R&D and extensive networking facilitated the search conducted by the founder to develop technologies to improve products and processes in the chemical engineering industry. Product involved improving a process by placing inserts into heat exchangers to improve efficiency and decrease maintenance requirements.
Oxford Applied Research Ltd	1978	Deliberate Search	Search conducted into the technology of film devices and semiconductors. Won the Queens Award for Technology for the production of a reactive atom source for use in producing high temperature superconductors. Developing new products and processes in materials science was the company's main objective.
Acorn Computer Group	1977	Deliberate Search	Whilst developing ideas for a new microcomputer, the entrepreneurs learned that the BBC was planning to run a series on computer literacy. Acorn conducted a deliberate search by pooling their knowledge of computer systems and this enabled them to be well placed to identify opportunities relating to the BBC series. The search led to links being forged with the BBC and the production of the highly successful BBC Microcomputer.
Ellis Developments Ltd	1985	Deliberate Search	The founder searched for ways in which the knowledge he had accumulated through the textiles industry could be transferred into other industries. After networking in the biomedical industry, the firm developed technologies to improve upon the existing means of repairing damaged ligaments by weaving specific textile between the joints.
Source Computer Systems Ltd		Deliberate Search	Through deliberate search, Source recognised the opportunity to produce intelligent data collection terminals that were suited to the emerging microcomputer market. They recognised the change in the computer industries structure and identified the opportunity that was available as a result of this.

Ambic Equipment Ltd	1977	Deliberate Search	The creation of Ambic Equipment Ltd was centred upon the development of dairy equipment, through both deliberate search and extensive networking. The first of many innovations was designed to improve upon the process of filtering milk. The new design improved the process by increasing performance and allowing the filter to be reusable.
S&S International	1983	Deliberate Search	After recognising the opportunities that were to be created by the rapid growth in the PC market, S&SI searched for ways in which to improve upon the basic software packages that currently existed. Through deliberate search they found that the existing spreadsheet package '123' had serious limitations. The company continued the search to find solutions to these limitations and this led to the production of the highly successful spreadsheet package 'The Pound'.
Stepp Ltd	1982	Deliberate Search	Deliberate search conducted with the aim to produce a combination of a guitar and synthesiser. For years guitarists had been looking for a way to use synthesisers without having to play a keyboard. Stepp conducted a deliberate search with the aim of finding a new, innovative way of solving this problem. The product, DG1 was the first to successfully combine both elements of guitar and keyboard.
Metapraxis	1984	Deliberate Search	Metapraxis is a niche management consultancy, which advises chief executives and finance directors in terms of top level management and business analysis. The founders worked together to combine their knowledge in a way that allowed for the recognition of this niche market by exploring the industry/market structures and service processes.
Universal Machine Intelligence	1983	Deliberate Search	UMI was concerned with the research and development of light industrial robots. Both founders had experience from within the robotics field and thus conducted a deliberate search within this industry for new opportunities. They found that there was a niche that was not being satisfied. This niche concerned machines that combined accuracy and power with cheapness and mobility.
Vax Ltd	1979	Deliberate Search	The innovation process began in 1968 when the founder set up a contract cleaning business to satisfy the industrial sector. After several years in this industry, he noted that the domestic cleaning products that were being imported from the US that were leading the market were poor in comparison to the products he was using for the industrial sector. From this he conducted a deliberate search into

			the ways in which he could use the technology he had developed for industrial cleaning to develop domestic products that would improve upon the current offering.
April Computing Ltd	1985	EA	Through entrepreneurial alertness the founder was able to successfully recognise the opportunity to produce the new innovation of an automated aseptic biosampler which replaced the previous process of manually transporting the samples. This innovation improved upon a process *need* by recognising the problem and improving the process by tailoring an innovative solution.
Knotless Fishing Tackle	1984	EA	Knotless Fishing Tackle (KFT) was established in 1984 after the entrepreneur who, given particular incentives and technical know-how, was able to spot the emerging business opportunity to produce a specialist fishing wire that solved a problem common to all fishermen.
Nextbase Ltd	1987	EA	NextBase Ltd was created with the intention of developing and marketing route-finding software. Although navigational, route-finding software already existed in 1987, it was written and designed for large mainframe computers with memories that were capable of accommodating the large quantities of geographical information that was required. However, the opportunity that was recognised by the founder was to capitalise on the mass PC market of both home and business.
Smokecloak	1992	EA	Established with the aim to manufacture and sell a unique burglar alarm system that once activated, emits a harmless smoke that can reduce visibility to approximately 30cm. The entrepreneur was dissatisfied with the current burglar alarm systems available after his store was broken into several times. The initial idea for Smokecloak came after a chance conversation with a policeman who suggested that burglars could rarely be stopped, only slowed down. From this the founder began to consider methods, by which burglars could be slowed. His thought process led to the recognition of the opportunity to produce this unique product.
Airdata Ltd	1986	EA	Formed after the identification of a new product innovation. This product was a flight planning system that consisted of a microcomputer based planning programme for flight crew. Previous to this innovation, flight planning was carried out manually.

Industrial Noise and Vibration Centre	1985	EA	Established to perform a consultancy service with regards to monitoring industrial noise and vibration. Through forging links with engineers and the Lucas Industries Noise Centre the founder was able to recognise the opportunity to incrementally innovate upon existing processes to offer improved solutions to industrial noise and vibration.
Microwriter Ltd	1978	EA	Established after the recognition of the opportunity to produce hand held word processing devices. The founders centred this on the creation of 'Microwriting', a method of generating all alphanumeric characters using only five keys.
Ship and Marine Data Systems	1987	EA	Formed after opportunities to develop products based upon the marine Voyage Data Recorder were identified. The founder recognised that the VDR systems could be further developed in order to monitor hull response to load stresses in real time. This increased the commercial viability of VDRs and led to the creation of the first real-time Hull-Stress Monitoring System (HSM). This resulted in the innovation of the 'StressAlert'.
Space-Time Systems	1979	EA	STS was created after the opportunity to improve a process need with a theatre box office system was recognised by the founder after a chance comment made by an individual who expressed dissatisfaction with the current products available.
Biopharm	1984	EA	After years of working within the zoological industry, the entrepreneur recognised the opportunity to utilise the knowledge he had gained in this field. The company was formed after the recognition of the opportunity to isolate substances from blood-sucking animals that have the potential to provide drug treatment for cardiovascular diseases.
Perchem Ltd	1978	EA	The company was formed after the recognition of the opportunity to develop and market a new cost efficient and innovative process of chemically producing 'organoclays' used in the manufacture of drilling muds for the oil industry and in the cosmetics and print industry.
ADC Systems	1982	EA	The entrepreneur recognised the opportunity to improve a process need by automating what was previously a highly skilled manual process which was time consuming and prone to inaccuracy. The need existed for a blood analysing technique that could test samples mechanically and without supervision and produce accurate results.

			The entrepreneur graduated as a Biochemist and built up extensive business knowledge including new product development consultancy. The opportunity was recognised while working as a research scientist testing the effects of dosages of chemicals prescribed by doctors.
Bartington Instruments Ltd	1985	EA	While working as an engineer, the entrepreneur recognised that there were gaps in the existing market for equipment concerning magnetic measurement. The entrepreneur had extensive knowledge of the problem and was able to recognise opportunities to produce solutions and improve upon existing products and processes.
W Industries	1982	EA	The opportunity relates to 'high street' Virtual Reality gaming machines for the entertainment industry. The firm consists of the founder entrepreneur and three friends who met while studying CAD at university. The founder provided much of the innovative capacity and spotted the opportunity to move into this market through the pooling of the teams extensive CAD knowledge.
Crocus Ltd	1986	EA	The process of opportunity recognition began after the group of founder entrepreneurs purchased the intellectual property rights for the 'Cartesian' model from their previous employers. From this the founders used the knowledge gained from years of experience in the robotics field to satisfy a niche market using the IPR of their previous employers product.
Safecom Ltd	1984	EA	The two founder entrepreneurs established Safecom Ltd after recognising the opportunity to develop and produce products for the mining industry. The founders had worked within the industry for British Coal for many years, and using the experience and knowledge gained through this, they identified a new market need for an improved rope haulage system.
Densa Electronics Ltd	1986	EA	The rationale behind the creation of the firm was the recognition of the opportunity to design and manufacture a respiration monitor for infants. The founders, a businessman and an electrical engineer identified the need for this opportunity after the coupling of prior knowledge and new related information.
Systematica	1986	EA	Systematica was established after the founders recognised the need for CASE tools, in other words, computer software applications that enable users to write their own applications with greater simplicity. This was a reaction to the growing PC market, and was recognised when the founders, who had worked for a group involved in the defence agency, needed such a product in a project they

			were working on and found that there was no such product available.
Rotabolt Ltd	1979	EA	The opportunity to produce the innovation that led to the creation of Rotabolt came after three co-workers experienced problems with the bolt failure on a 'rolling mill cylinder'. They recognised the opportunity to improve this process by designing and producing a new type of bolt to overcome the problem.
Elonex	1986	Both	The founder established this venture after successfully coupling together a number of different inputs, which allowed him to perceive that an exploitable opportunity had emerged in the PC sales market. In researching information for a new business venture that he had become interested in, he soon discovered that the cost of acquiring a new PC could be greatly reduced if new means of purchasing were explored. By importing generic PCs directly from Taiwan, the customer could receive an equally competent PC for a fraction of the price.
Hydraroll Ltd	1978	Both	As a cargo expert for the Royal Navy, the founder entrepreneur was closely involved with the Navy's dock loading system. Whilst working in this position he formed a user network in order to assess the perceived inefficiencies and limitations of the current technologies available. It was through this network that the idea of creating Hydraroll was conceived based on his experiences and the knowledge that he had gained from his role in the Royal Navy. Hydraroll's core product is a materials handling system that is able to move loads to and from road haulage vehicles with significant ease and speed. The innovation from which Hydraroll was born concerns a pneumatic roller track with an innovative slip-chain that not only improves speed and efficiency but also enables the unloading process to become fully automated.
Hydro Research & Development	1980	Both	HRD was established after the founder entrepreneurs recognised the opportunity that a technology that had been developed by a family member could have on the storm water and sewage treatment market. When introduced to the principles that had been earlier developed, the two entrepreneurs instantly recognised that the technology he had pioneered could have an enormous impact on the British market

Lloyd Doyle	1982	Both	Lloyd Doyle was formed after the recognition of the opportunity to create a machine for optically inspecting printed circuit boards (PCBs). Whilst working in an electronic company they discovered a problem with the reliability of the PCBs that was brought to their attention by users. In researching the problem they discovered that the cause lay in the impracticality of trying to assess the boards with the naked eye. They discovered that neither the machine nor the company existed, and were inspired to exploit the opportunity to fill this gap.
SRM Engineering	1982	Both	SRM was established specifically to fill the vacuum on the market caused by the dissolution of the BSA Motorcycle company, the increase in demand for classic motorcycles and the large amount of poor quality pattern parts available on the market. Before establishing SRM, the founder entrepreneur worked as an instrument technician and had a personal interest in BSA motorcycles. This provided the technical expertise required to recognise the opportunity to create the firm.
Oxford Lasers	1977	Both	The founder entrepreneur recognised the opportunity to create Oxford Lasers after he identified both the commercial potential of research carried out at Clarendon Labs and the reluctance of established companies to accept these findings. On the basis of this, he and three others established Oxford Lasers in order to research and test the commercial viabilities of laser technologies.
Linx Printing Technologies Plc	1986	Both	Linx Print Technologies Plc was established with the aim of producing high-quality continuous ink-jet printers (CIJ). The opportunity to compete in this market was recognised by two founders, and after hiring a further two employees were able to pool their existing knowledge of managerial, marketing skills and a technological awareness of CIJ printers. The innovation was not the first to market, but was an incremental innovation as it incorporated new user-friendliness, reliability, quality and cost savings that were demanded by the market.
Ritec	1981	Both	The innovation that led to the creation of Ritec was identified by one of the two founder members. He recognised the commercial potential that harboured in a type of polyurethane that would significantly enhance the protective treatment of glass and revolutionise the industry. The innovation was later adapted in order to be commercialised as a cleaning product.

Filtronic Components Ltd	1977	Both	During the 1970s, the founder entrepreneur was involved in a research project at Leeds University that led to the development of 'suspended stripline substate' technology for use in radio and microwave applications. Following this, he recognised the opportunity to commercialise this technology within the defence industry for application to radar and microwave filtering. For this reason, Filtronic was founded.
IQ Bio Ltd	1981	Both	IQ Bio Ltd was formed after the two founder entrepreneurs discovered a novel way of improving an existing diagnostic process. The recognition to couple the use of existing scientific knowledge with a novel application led to the creation of a new process within the biotechnology industry. The innovation involved employing a second enzyme in order to amplify the results of an existing cost effective but insensitive diagnostic process.
Boothroyd Stuart Meridian Limited	1977	Both	The two founders worked together on numerous projects for their previous employer. One such project was to design a hi-fi amplifier and loudspeaker combination for a company called Lecson Audio Ltd. Although their product was well received, the company failed to meet the demand it created. Following this, the two entrepreneurs set up as an independent design consultant and were approached by a group of investors who wanted them to design a similar system. Again the product was well received but the demand was not met. The frustration of this led the entrepreneurs to look for ways in which their skills could be utilised and this led to the creation of BSM Ltd. The company was formed in order to create high quality audio equipment in order to cater for the niche markets they had identified in completing their previous two projects.
Division Group Plc	1989	Both	Division Group was created after the four founder entrepreneurs developed the groundbreaking technology that led to the debut of virtual reality as a marketed product. The four founders recognised the opportunities that existed after perceiving that their expertise and knowledge could be translated into developing VR.