

# **Realizing Potential: The Impact of Business Incubation upon the Absorptive Capacity of New Technology Based Firms**

## **Introduction**

Penrose (1959) suggested that firm growth is dependent upon the application of entrepreneurial and managerial knowledge configured as resources. Entrepreneurial resources are essential for opportunity recognition and innovation whilst managerial resources are necessary to develop systems and processes that enable such opportunities to be exploited. Consequently, firm growth is dependent upon knowledge acquisition and application; this has implications for the development of early stage firms particularly where founders have limited business experience, resources and network alliances to inform this process (Stinchcombe, 1965; Shepherd et al., 2000; Shane and Khurana, 2003; Ferguson and Olofsson, 2004). Consequently, these limitations constrain the accumulation of resources which might effectively expand the managerial knowledge base of owners; this in turn, restrains entrepreneurial capacity (Holmqvist, 2003; Arnold et al., 2004, Hughes et al., 2007).

Business incubation is deemed to be one solution to addressing such challenges and constraints as it offers access to a diverse range of on-site resources, support and advice (Smilor, 1987; Hacket and Dilts, 2004; NESTA, 2008). As such, it might be assumed that incubated firms would demonstrate unambiguous sustainability and performance advantages when compared to their non-incubated counterparts. However, the extant evidence is by no means clear regarding the influence of incubation upon the performance of new ventures (Aernoudt, 2004; NESTA, 2008; Scillitoe and Chakrabarti, 2010). Whilst ready access to premises, professional support and attaining a credible business address is certainly useful for very early stage firms (Mian, 1996; Autio and Klofsten, 1998; Albert and Gaynor, 2003; Scillitoe and Chakrabarti, 2010) there is some debate regarding the positive impact of incubation upon the process whereby opportunity recognition is commercialized and transformed into a viable venture (Mian, 1996; Albert and Gaynor, 2003; Scillitoe and Chakrabarti, 2010). Thus, whilst the potential for incubation to provide tacit support for early stage ventures is quite convincing, the degree to which they actually benefit the acquisition and exploitation of knowledge transfer and importantly, the managerial skills to exploit this process is less certain (Hacket and Dilts, 2004; NESTA, 2008)

Accordingly, this paper explores this issue in more depth. Specifically, the aim is to analyse the incubation process through the lens of absorptive capacity to critically evaluate how it might strengthen the business model of new technology firms. Therefore, the unit of analysis informing this discussion is the University Technology Business Incubator; defined by Mian (1996: 325) as an “*enterprise development tool employed by some entrepreneurial universities to provide support for nurturing new technology based firms*”. To analytically frame this proposition the research draws upon the notion of absorptive capacity. This construct refers to a firm’s ability to acquire, assimilate, transform and exploit knowledge from external sources to generate strategic gains (Cohen and Levinthal, 1990); and has been extensively used to analyse the processual development, application and commercialization of new and emerging technologies (Jones and Craven, 2001; Rothaermel and Thursby, 2005; Lane et al., 2006; Todorova and Durisin, 2007). This paper builds upon this construct and investigates how the process of incubation, within a UTBI, impacts upon the relationship between potential and realized absorptive capacity to support the commercialisation of technological ideas. As such, the research explores the process by which a UTBI enhances

absorptive capacity by enabling knowledge development and critically, facilitating the transformation of knowledge into a resource which supports business development and sustainability. Empirically, a detailed case study is presented with evidence drawn from founders, external advisors and incubator directors which illustrates how incubation – as a process – has the potential to enhance the knowledge base of the new firm enabling the realization of potential absorptive capacity.

The paper commences by re-engaging with the debate that knowledge, both entrepreneurial and managerial, underpins firm growth, it then considers the problems that this inevitably creates for early stage technology firms. To establish an analytical frame, the research considers the notion of absorptive capacity and the factors that influence the ability of firms to engage in practices to support the business development of a technological idea. This leads into a debate on the elements, within the incubation process that have potential to support the acquisition and exploitation of knowledge and the outcomes such activity might create. To illustrate these arguments, case study evidence from two UTBIs is employed and, based upon a combination of analysis and evidence, implications are considered and conclusions drawn.

## **Literature Review**

### ***Knowledge and firm growth***

The significance of differentiated forms of knowledge enabling firm growth are identified by Penrose (1959) when making the distinction between entrepreneurial knowledge, important for opportunity recognition and innovation, and managerial knowledge, necessary to exploit such opportunities. Consequently, firm growth is closely aligned to knowledge acquisition and application (ibid); this has implications for the development of early stage firms particularly where founders have limited experience of the business context. So, there is potential here for an adverse effect upon the opportunity to commercially exploit identified opportunities (Stinchcombe, 1965; Shane and Venkataraman, 2000; Ardichvili et al., 2003; Ferguson and Olofsson, 2004). Indeed, Arnold et al., (2004) argue that a common weakness amongst early stage firms is a failure to acknowledge and search for external sources of managerial knowledge compounded by limited access to networks and constrained explorative activities that combine to impact upon entrepreneurial capacity (Holmqvist, 2003; Hughes et al., 2007).

For the purposes of this paper, knowledge is defined as “*information combined with experience, context, interpretation and reflection; it is a high value form of information that is ready to apply to decisions and actions*” (Davenport et al., 1998: 46). This reflects the stance taken by Gibb (1997) which recognises the association between knowledge and skill where the former is necessary to exercise the latter; thus, knowledge is a resource accrued from learning that can be implemented within specific contexts (Dalley and Hamilton, 2000). As such, knowledge is an outcome of information and learning which, in an entrepreneurial context, is an experiential problem centred process (Cope and Watts, 2000); this utilizes information gleaned from others (exploitative learning), or via experimentation (explorative learning). However, context is critical in shaping this process (see Hjorth, Jones and Gartner, 2008); context arises from and is formed by situated antecedent factors (prior experiences) or as Johns (2006: 386) notes “*situational opportunities and constraints that affect the occurrence and meaning of behaviour as well as functional relationships between variables*”. Accordingly, as human actors, we draw upon context to acquire, assimilate and make sense of information which may or may not be converted into knowledge. Thus, context influences

the learning process and so, facilitates the acquisition and assimilation of knowledge which in turn, fosters a process of reflection and analysis which dictates how knowledge is transformed and exploited to support business development.

### ***The role of knowledge in building absorptive capacity***

The creation and exploitation of knowledge underpins the concept of absorptive capacity defined by Cohen and Levinthal (1990:128) as, “*a firm’s ability to recognise the value of new, external knowledge, assimilate it, and apply it to commercial ends*”. Absorptive capacity reflects a firm’s ability to develop, over time, through the accumulation of relevant knowledge and has been linked with improved firm performance (Zahra and Hayton, 2008; Chen et al., 2009; Volberda et al., 2010) and competitive advantage (Tsai, 2001; Lenox and King, 2004; Chen et al., 2009). This single construct took on a more processual form when broken down into two components by Zahra and George (2002): potential absorptive capacity, the processes undertaken to acquire and assimilate new knowledge, and realized absorptive capacity, which describes how new knowledge is transformed to bring about commercial gain. Potential absorptive capacity is developed from ‘acquisition’ which refers to an ability to recognize value and acquire external knowledge critical to firm operation and ‘assimilation’ which refers to routines and processes that allow the understanding, analysis and interpretation of information from external sources. For potential absorptive capacity to become realised a process of transformation is required; this key factor has two components, internalization and conversion; the former refers to the founder’s ability to develop routines that facilitate the combination of existing knowledge with newly acquired knowledge; the latter refers to the commercial application of new knowledge with the intent of achieving organizational objectives (Lane and Lubatkin, 1998). The transformation of newly acquired knowledge is not likely to occur instantaneously as prior knowledge is essential to a firm’s ability to value new knowledge (Zahra and George, 2002). As firms acquire knowledge from a wider catchment of external sources, it is less likely that the firm will possess the prior knowledge necessary to fully comprehend and appropriately value its discoveries; there is likely, therefore to be a lead time between potential and realised absorptive capacity and, in some cases, simply missed opportunities. It is possible to reduce the time and costs associated with this lead time if the appropriate support is available. Absorptive capacity therefore, offers a theoretical framework for probing the acquisition, assimilation, transformation and exploitation of knowledge flows within and between organisations reflecting the activity expected of the business incubation process (Lane and Lubatkin, 1998; Zahra and George, 2002; Todorova and Durisin, 2007).

The extant literature points to a number of factors that affect the propensity to acquire, assimilate and exploit new knowledge: the characteristics of the knowledge being absorbed (Lane and Lubatkin, 1998; Barkema and Vermuelen, 1998), the process of transfer, within and between organisations (Lane and Lubatkin, 1998; Simonin, 1999; Gupta and Govindarajan, 2000) and the degree to which the parties sharing information have similar commercial objectives. In terms of knowledge characteristics, it has been suggested that where these are unfamiliar, or tacit, involving competencies that are interdependent, socially complex and difficult to codify, absorption becomes more problematic (Lane and Lubatkin, 1998; Barkema and Vermuelen, 1998; Simonin, 1999). Where such characteristics make understanding difficult, often the case within the development of high-growth/high-technology firms, it is important that the knowledge transfer process is supportive. So for example, Simonin (1999) and Gupta and Govindarajan (2000), suggest that the frequency of interaction and the quality of communication between the relevant parties are important factors to ensure a successful transfer of knowledge. Others, for example Child (1984); Dyer

and Singh (1998) and Zhang et al. (2006), have identified the need for empathy between knowledge sharing routines, complementarities between resources/capabilities and the capacity of the firm/founder to engage in knowledge sharing activities.

While reference to absorptive capacity in the extant literature has been significant, some authors have expressed concern with regard to the theoretical development of the concept (Lane et al., 2006; Easterby-Smith et al., 2008). Lane et al. (2006), in a comprehensive review of the literature provide two main critiques of the way in which the construct of absorptive capacity has developed. First, they argue that the majority of citations to Cohen and Levinthal's work (1990) involve little or no discussion of absorptive capacity; thus limiting the cumulative and coherent development of the construct. As a result, they suggest, this has resulted in reification, a taken-for-granted concept that no longer gets examined closely or critically. Second, as a consequence of reification an R&D focus has come to dominate the subsequent literature, resulting in a focus upon technological aspects at the expense of process-oriented knowledge such as managerial techniques, marketing knowledge and manufacturing know-how. While supporting the notion of 'reification' Easterby-Smith et al. (2008) suggest that the limited progression of the absorptive capacity lies in the dominant use of quantitative research methods which are more appropriate to test, rather than develop, theory. They go on to state that "*new ideas and perspectives are more likely to be added if qualitative methods are used to examine absorptive capacity*" Easterby-Smith et al., 2008: 485).

Drawing from this discussion of the two literature sets, the research identifies the need to effectively combine entrepreneurial and managerial knowledge to exploit identified business opportunities and, in the context of early stage firms, that this has resonance with process by which potential absorptive capacity is realized. Both are processual interactions and are constrained or enabled through context. Accordingly, to evaluate the critical arguments raised by the extant literature regarding learning approaches and their relationship to absorptive capacity, this study focuses upon the UTBI context and specifically, how it improves knowledge and understanding in early stage founders to support the business development of technological ideas and convert potential into realised absorptive capacity (Garrett-Jones et al., 2006; Lane et al., 2006). As such, absorptive capacity is considered as a dynamic construct that evolves as a consequence of the iterations between all of those involved within an incubation process. Thus a processual analysis is employed to explore the nature of absorptive capacity and how these notions are developed and interact within the context of the UTBI. As Pettigrew suggests (1997), a processual method of analysis helps to explore the "*dynamic qualities of human conduct .....and to embed such dynamics over time in the various layers of context in which streams of activity occur*" (p.347).

### ***The value of incubation***

As noted in the introduction, there is some debate regarding the potential to add value from incubation. Previous literatures (Smilor, 1987; Hacket and Dilts, 2004; NESTA, 2008) have offered a supply side view of the incubation process; i.e. introducing founders with entrepreneurial ideas to a range of support mechanisms such as office and laboratory space, administrative staff and meeting rooms – all of potential value to early stage firms. Moreover, incubators constitute a physical site where less tangible but critical business resources are concentrated and made accessible to new venture owners for exploitation. For example, the insight, advice and support of advisors, investors, venture capital fund managers,

intellectual property experts et cetera are a critical element of the incubation community whose knowledge and networks new venture owners can access and exploit (Hite and Hesterley, 2001; Rice, 2002; Lee and Osteryoung, 2004; Ferguson and Olofsson, 2004; McAdam and Marlow, 2007; Bruneel et al., 2012). However, the process by which this range of seemingly beneficial resources are effectively translated into distinct and positive advantages for new technology firms remains unclear given the complexity of analyzing the nuanced interchanges which occur within specific incubators. Hence, the difficulty of generating academic consensus regarding the contribution of incubation; in effect, the diverse range of 'ingredients' drawn into incubators suggest that positive benefits should accrue to tenants but how these are 'mixed' is critical in shaping outcomes remain unclear (Mian, 1996; Autio and Klofsten, 1998; Albert and Gaynor, 2003; Scillitoe and Chakrabarti, 2010)

The influence of contextual heterogeneity and the confusion this prompts regarding the benefits of incubation is evident within the prevailing literature (Aernoudt, 2004; Ferguson and Olofsson, 2004). To take the particular example of technology business incubators, although sharing a similar sectoral framing as a conduit for information exchange, differences in effectiveness are apparent. The study by Rothaermel and Thursby (2005) suggested that UTBIs should facilitate technological knowledge flows, identified as licenses and citations of university research found in patents, from the university to the incubator firms and, that such flows, of technical knowledge, should enhance firm performance. While finding some support for this hypothesis their main finding indicated that a firms' absorptive capacity was an important factor when transforming university (technical) knowledge into firm level competitive advantage. Studdard (2006), who also explored the potential for knowledge development arising from founder interaction with incubator managers found evidence for improvement in firm credibility but little evidence for any contribution to technical competence. Consequently, Studdard suggests that incubator managers who actively engaged with supporting and enhancing technological expertise were unlikely to provide ostensible benefits. Such arguments reflect earlier work by Rice and Mathews (1995) suggesting the most productive pathway to add value to new technology ventures lies in the development of managerial and business skills. Thus, it is recognised that under conditions of incubator heterogeneity combined with the diversity of available resources, it is challenging to identify consistent and uniform benefits arising from incubation.

Consequently, it is suggested that a more productive approach to evaluating the contribution of incubation lies in analysing the process whereby potential benefits might be generated. So, the focus here is upon how incubator managers can actively work with founders to enhance their commercial expertise, using the resources of the UTBI to create a complementary skill set of entrepreneurial/technical and managerial knowledge to enhance the business model of new technology firms. To understand how this evolves an absorptive capacity framework is employed to explore how the diverse range of resources embedded within the fabric of the UTBI can be effectively absorbed and translated into knowledge which strengthens business development and potential.

### **Case study context and research methodology**

The research was conducted with firms based in the university incubators at Southampton and Bristol that form part of the SETsquared collaboration between 2009 and 2011. These incubators were selected because of their focus upon technology business and their track record, recognized in a variety of reports and related media (Library House, 2007; NESTA,

2008; Financial Times, 2008; Daily Telegraph 2010), in raising external funds and commercially exploiting innovative ideas. Although both incubators have independent directors, they share a common iterative approach which is directly comparable. This approach reflects a '*business acceleration*' format which concentrates upon the commercialisation of technological ideas and provides common services and support which in some cases, for example an investment readiness programme and a mentor network, are completely shared. In addition, the firms involved in each incubator exhibit similar characteristics; they are all early stage technology start-ups; the majority (approximately 85% of tenants) external to the universities and, while the firms have seen additions to their management teams, the original founders still held a strategic role. So, whilst the sites are physically distinct, they share an ethos and objective which generates complementarity.

This paper interrogates how the incubation process might strengthen the business model of new technology firms and respondents have been drawn from both sites to add depth and richness to the data that relates to the incubation process. The incubation support is delivered via an iterative process that concentrates upon strategic planning, development of the management team and securing appropriate investment and is implemented through workshops, business review panels, the exploitation of internal and external networks and the intervention of the incubator directors. However, as the literature suggests, new venture founders make selective use of available resources and have differing views and experiences regarding the quality and value of the support and advice offered (Rice, 2002; McAdam and Marlow, 2011). Therefore the iterative process employed is not formulaic but bespoke as it depends upon the reaction of the owner-manager to previous interventions aimed at supporting the commercialisation of the idea. It is both a dynamic and complex process which would help to explain Mian's observation (1996: 327) that "*there is no consensus on what makes up the content of successful UTBI's management practices in providing an optimal set of technology and business incubation services and how the value-added contributions of these services may be enhanced*". To improve this situation, there is a need to explore the views and experiences of all who are involved within the incubation process to critically evaluate how the diverse resources available to early stage founders enable potential absorptive capacity to be realised. Accordingly, interviews were conducted with the key participants within the UTBI process, business founders, the incubator director, external business support agencies and mentors (Rice, 2002, Hacket and Dilts, 2005), and explored how these stakeholders interact to build absorptive capacity within incubator firms. In the first instance, the paper looks specifically at the context of the incubator and the impact it has upon the knowledge development of founders; the process by which it melds experience, interpretation and reflection to support the learning process. Secondly, interview findings are presented which reflect upon how or if the incubation process supports the transition from potential to realised absorptive capacity (transformation and exploitation) so facilitating the commercialisation of business proposals. Finally, a critical evaluation is offered of the factors which contribute to the variable impact of the incubator process on the development of 'potential' and 'realised' absorptive capacity.

As the research seeks to explore the views and experiences of all who are involved within the incubation process an interpretive approach is axiomatic (see Robson, 2002; Mosey and Wright, 2007). The unit of analysis here is the business incubator which contextualizes the research site and is congruent with the objective to build an in-depth comparative analysis between the key actors within the incubation process, as a consequence a case study methodology is adopted. So, data was initially collected through a period of observation and conversation with incubator directors, business founders and external professional advisors

which provided a detailed understanding of how the incubators operated. In addition, information was also collated from secondary data sources including annual reports, exit questionnaires and summaries from the formal review process undertaken on firms involved in the incubator process. A purposive sample was selected of potential founder respondents whose firms had at least two years incubation experience; this enabled more reflective comment based upon a longitudinal intervention from all respondents. Of those 71 firms that met this criteria 27 agreed to be interviewed (38% of potential respondents). In addition to the above characteristics, the firms interviewed were technology companies, started in the last five years that had actively engaged in the incubator process. To provide more detail and to cross reference information provided by founders' interviews were also conducted with nine external advisors that had worked with firms and both incubator directors.

As indicated, how the various ingredients of an incubator process are 'mixed' to support business development is complex and, it is unlikely that any formulaic solution could be identified that met the demands of the heterogeneous mix of firms that seek support through incubation (Mian, 1996; Autio and Klofsten, 1998; Albert and Gaynor, 2003; Scillitoe and Chakrabarti, 2010). This paper, therefore, reports on an exploratory case based piece of research which employs semi-structured interviews as its main research instrument; identified by Yin (2004) as appropriate for work of this scope and depth of inquiry. Discussing the incubation process with those critically involved with the development of the business enabled the triangulation of a shared process but from differing perspectives and so, revealed conflicting and mutually held perceptions and experiences. This information was also checked against information from secondary data sources and observations previously identified. This led to an iterative process of theory development and re-examination of the data to build a composite picture of business development activity within the incubator (Strauss and Corbin, 1990). Within the interview schedule, founders were interviewed first followed by the two directors and finally, the external advisors. Adopting this approach enabled founders to describe in detail their business proposal and its development, attitudes towards the incubator and its director, perceptions of their own strengths and weaknesses, and how the incubator had supported their development. This information then informed the development of the questionnaires employed in subsequent interviews.

The interviews lasted between one and two hours; they were digitally recorded with separate notes made to highlight key points to provide a chain of evidence (Voss, 2002). The interviews focused upon the activity generated within the incubator, the interaction of individuals within the incubator, the types of knowledge and information requested by owner-managers and the timing of those requests, the process by which this knowledge was acquired and assimilated and how this led to the adoption and implementation of particular ideas that helped to strengthen the business model. The information from the interviews was interrogated using the absorptive capacity framework (Zahra and George, 2002) to investigate the contribution of the incubation process to potential (acquisition and assimilation) and realized (transformation and exploitation) absorptive capacity (see appendix one). Information derived from the three sets of respondents was triangulated to identify consistencies and differences; and finally as a complete cohort. The findings were then submitted to all participants for clarification and verification which, as Eisenhardt (1989) notes, is critical to enhance the richness of the data through complimentary insights.

## Findings and Discussion

The findings are presented to illustrate the applicability of the absorptive capacity framework to explain the business development process undertaken by firms within the incubators under investigation. The analysis, in the first instance, explores the contribution of the incubation process towards the acquisition and assimilation of new knowledge. Subsequently an evaluation was made whether the resources made available through incubation support the transformation and exploitation of such knowledge effectively taking early stage technology firms from potential absorptive capacity through to realised absorptive capacity. In developing this analysis consideration is given to the characteristics within incubator firms and the incubator process that facilitates and enhances a firm's ability to learn, increase knowledge and build absorptive capacity.

***Potential absorptive capacity: acquisition and assimilation***

Acquisition and assimilation are explored with reference to the process of entry and the early interactions within the two incubators under consideration. Entry to the incubator is predicated upon the founder submitting a written outline of the business idea; if deemed a viable proposition, founders are invited to interview with the incubator director to discuss development plans. It is typical, during this phase, for the founder to concentrate upon the underlying technology and place less emphasis on business development (Oakey, 2003). Thus, founders already possess the technological knowledge and expertise that underpins the business idea; clearly, this is a critical antecedent factor. Accordingly, the primary motivation for incubation is to support a founder's knowledge acquisition which enables them to exercise the necessary business development skills to exploit the technological idea. The technology can then be said to have potential absorptive capacity but, for it to be transformed and exploited, it requires additional managerial knowledge (Penrose, 1959) which must be embedded within the firm.

It is therefore, critical to identify and analyse the process by which the incubator supports founders in the necessary development of managerial knowledge to realise the potential of the technological idea. Meeting the entry requirements of the incubator was identified by many of the founders as the first time they had attempted to formally explain their ideas to a third party. The act of rehearsing their presentation and providing a short written proposal begins a reflective process which in itself challenges existing perceptions and generates potential to assimilate new knowledge as dialogue ensues between founders, incubator directors and external advisors. As founder five suggests: *'the application process got me thinking again and I started to question everything; not just the idea, but why I wanted to do it'*. Upon formal entry to the incubator, founders were asked to develop a more formal business proposal to indicate how the technology would be operationalised in the context of potential markets *'it is a test of how committed the founder is to the idea and of their desire to push the business on'* (incubator director one). At this stage, founders are not normally in a position, either in terms of skill or information to provide a detailed analysis, but the plan, limited to ten pages, is used as a template for future iterations, to highlight limitations, signpost towards areas of support and provide a basis for reflection. One founder was quite candid and indicated *'the process makes you thick-skinned, if you take it personal you won't get a great deal out of the process'* (founder eighteen); another suggested that *'if you are not up to speed (generic business environment) the contributions can just go over your head'* (founder eleven) The entry process and the writing of a plan encourages the founders to look beyond the technology and to begin to think about how this might drive an income stream; this helps to identify gaps in their understanding that need to be addressed and, hopefully, to recognise the value of such knowledge and investigate ways in which it might be acquired.



When founders enter the incubator, there is limited interaction with the incubator directors; they may ask questions and raise issues, but founders are purposively given room to resolve problems. Although the extant literature suggests that novice founders often lack experience, networks, and appropriate benchmarks to enable competent evaluations of business opportunities (Shane and Khurana, 2003), they are still reluctant to seek advice and support (Goffee and Scase, 1995; Storey and Greene, 2010). The incubator directors observed that encouraging founders to ‘problem solve’ highlighted the difficulties faced when converting new technologies into good businesses. This process identified knowledge gaps and encouraged founders to consider external advice and support: *‘I tried on my own for quite some time but I was getting nowhere, I went back to X (incubator director) and he pointed me in the right direction’* (founder 19). In addition, the Directors suggested that, having gone through this process and sought help, founders were in a better position to effectively use available sources of support. Seeking advice enables founders to develop more coherent business plans but also, this iterative process enables them to acquire and exploit new knowledge. The plan, dynamic in nature, becomes the framework through which knowledge acquisition can be assimilated; this was not an easy process as founder ten suggested: *‘no one I have spoken to wanted to do it or liked doing it (the business plan), but they all think the results are worth the pain’*.

As has been argued (Goffee and Scase, 1995; Storey and Greene, 2010) new firm founders are reluctant to both seek and act upon formal advice which has proved detrimental to the identification of weaknesses in the business model and access to resources which contribute to founder knowledge and business viability. In these cases however, the process necessitated that founders engage with external advisors and incubator directors; respondents perceived this to be a key element in supporting the development of the business. As founders two, nine and twelve observed, *‘it meant being able to take the technology beyond a neat idea’*, *‘it was the first time I realised that customers would be as important as the idea’*, *‘generally, technology does not sell itself; the planning process sorts out those individuals that want to take their proposition to market’*. Effectively, the plan facilitated the transformation process and became the bridge between the conceptual idea and commercial development. Encouraging the development of a coherent business plan prompts the acquisition of new knowledge to enact the proposal (Kim, 1998). Having to re-evaluate the commercial potential of the technology ensures that founders have to consider whether they possess the capabilities to exploit their ideas. Furthermore, they suggested that founders who were prepared to engage with and tolerate searching evaluations of their business model were, subsequently, more likely to seek the opinions of others, value constructive criticism and therefore, to benefit from future interventions.

Given that the incubation process persuaded founders to further develop their managerial competencies, the paper investigate how they acquired and assimilated the information necessary to develop these skills. It might be expected that the regular workshops would be critical to improve managerial expertise, but attendance was poor. Founders, despite being complimentary about such activities, did not relate these events to their immediate business development priorities. A number of reasons were identified; *‘the information needed to be more bespoke’*; (founder one) *‘the timing of the workshop occurred after the relevant issue had to be addressed’*; (founder thirteen) *‘the workshop occurred before I realized its importance to my business’*; (founder eighteen) *‘the workshop had no follow on’* (founder twenty-five). These issues led to irregular attendance which also limited the scope for networking and so, the opportunities for peer group learning.

As founders indicated that one of the main reasons for joining the incubator was the opportunity to be among like minded individuals, the peer to peer network would seem a logical source from which to acquire knowledge. However, the interaction between incubator firms was superficial despite the use of open plan workspaces, social networking events and the encouragement of incubator staff. The founders did not view this as problematic and were unconvinced that significant advantage could be gained from sharing knowledge and experiences – *'my business is very specific, I have talked to X (a founder) about which IP lawyer they used but that's as far as it goes I'm not sure what else we could help each other with'*. In exploring this issue in more depth, it became apparent that when seeking information with reference to managerial knowledge, founders were more likely to turn to an incubator director for advice. Much of the directors' knowledge was gleaned vicariously, through experiences with other tenant firms; founders believed that such interaction informed a wide range of experience which strengthened the scope and relevance of the advice offered. Founders were therefore able to obtain knowledge from a wider external catchment area but have it delivered through a known and trusted source who could offer bespoke support given their intimate knowledge of the founders, their ambitions and potential. This facilitates the assimilation of knowledge and, potentially, reduces lead times associated with its transformation.

Thus, the director was central in supporting the acquisition and assimilation of the founder's managerial knowledge and skills but this contribution hinged upon the development of a constructive working relationship. This was facilitated by the reflective induction process which, critically evaluated the technological opportunity and sought a detailed and concise business plan; both aspects encouraged interaction and enhanced dialogue between founders and incubator directors. The importance of the entry process was identified by two thirds of founders as an important event. First, it established common ground around the technology that offered founders confidence in the incubator directors knowledge, expertise and ability to support the firm; *'it was helpful to review the technology behind the idea first, this was where we were strong but X (incubator director) held his own and that established mutual respect'* (founder two). Second, the discussions highlighted limitations in their proposal - as one commented *'although we had looked at the potential value that our product could create for customers we had not investigated the switching costs that would be incurred by those customers and we were less than clear how we might assess these costs'* (founder eight). More importantly, founders pointed out the positive contribution made by the directors in resolving these issues *'the director identified weaknesses in my business proposal.....but that's easy, the helpful thing was sitting down and explaining how it could be improved and showing me where I could get information to help'*. Founders acknowledged that the early interactions with the incubation process and, in particular, with the directors, increased their confidence and encouraged them to seek further assistance later in the incubation process. *'From the outset I was able to have a conversation with X (incubator director); he understood the business but, more importantly, he understood the technology behind it'* (founder three). *'I liked the idea that he knew how the technology worked, somehow that gave me greater confidence'* (founder ten)

There was more explicit interaction between founders and the external advisors which normally took the form of personal interaction allowing founders to address and resolve a problem or query quickly. Over time however, such advisors were used less frequently; as directors, because of their own experiential learning, were able to identify appropriate solutions. The tendency therefore, was for founders to consult the director who either suggested a solution or provided the appropriate contact from the external advisor network.

This system was considered very efficient and effective; founders obtained the information they needed quickly and external advisors were not overwhelmed with queries, responding efficiently and effectively when required.

***Realized absorptive capacity: transformation and exploitation***

There are two components associated with the concept of transformation, internalization and conversion (Lane and Lubatkin, 1998). Drawing out the information from founders, incubator directors and external advisors, three issues were perceived as important when applying knowledge to an individual firm context and then converting such knowledge to support business development. First, founders had to be confident in the source of the information and, importantly, understand its potential value to the business. The main conduit for information was the incubator director; an early demonstration of technological knowledge helped cement the relationship in the initial exchanges. Various comments were made regarding these early experiences - *'from the start X (incubator director) had demonstrated his understanding of the technology and its business potential'* (founder six); *'I viewed the early stages as a proving ground both for me and those involved in the incubator we both had to show we had what it takes'* (founder fourteen). Second, founders have to be ready and able to act; thus, the timing of interventions, to encourage transformation and exploitation, is crucial. Driving a young, high risk business is a difficult and uncertain process thus, understanding when it is a good time to push and when it is more appropriate to consolidate – is essential to ensure that founders are receptive to advice, learning and knowledge acquisition. *'X the incubator director was very good at knowing when things were not going well and he would suggest a catch-up which often re- focused my attention on the key issues to be addressed and brought me back to key milestones we had previously agreed'*. A third issue was the opportunity to test assumptions and reflect upon the implication of actions. This was achieved in a number of ways; through 'one to ones' with the incubator director, discussions with advisors and via regular review panels. The content of the discussions covered a variety of activities. In terms of operations founders were keen to be walked through the process of selling, identifying the people to contact, how the approach should be made, what the pitch should entail, where you should hope to get to by the first meeting and when and how to follow-up. The strategic discussions related to raising funds, the prioritisation of resources post-investment, the employment of staff and changes to the business plan or markets being targeted. Consequently, when dealing with this type of information, founders have to be both willing and able to engage with the process if potential absorptive capacity is to be realised from the incubation process.

Investigating this activity in more detail, the review panels offer the founders the opportunity to engage in a reflective learning experience; they set the agenda but the discussions are rarely confined to these issues. It is through such activities that founders have the opportunity to develop and refine the practices that help to combine existing knowledge with newly acquired and assimilated knowledge. A number of founders made positive comments on this process; one suggested that *'it gave me an opportunity to reflect on how far the business proposal had come in the previous six months'* another said *'it made me think hard about the direction I had taken the business and look back at some of the "forks in the road".'* Consequently, the founders can take advantage of a range of informed comment from a variety of perspectives and while attempts are made to draw the debate to a logical conclusion there are, inevitably, differences of opinion. One founder confessed *'I was more confused at the end of the review than when I went in'* and this type of issue is dealt with in the post-review meeting with the incubator director; set up, specifically, to operationalize the advice that has been offered.

Founders believed the review experience to be broadly positive: *'for the first time I was able to stand outside the business and look in'* (founder eight), *'there were no punches pulled and it was just what I needed'* (Founder 12), *'it provided food for thought'* (Founder 15), *'there were a lot of ideas expressed and it set me thinking'* (Founder 18), *'it confirmed I was on the right track'* (Founder twenty-one). While a typical response from an external advisor indicated the panels offered *'a healthy, open and honest debate that perhaps raised more questions than answers'*. The reviews, therefore, present learning that is both exploitative and explorative; the review can provide founders with quick fixes to problems being encountered but they also generate a variety of conflicting comment and advice of a strategic nature. Founders use the post-review process and the assistance of the incubator director to internalize this knowledge and convert it, through experimentation, into something that works for them.

Mentors also play a key role in the transformation process; they are often sources of knowledge but more importantly, they are a sounding board when founders are trying to cope with absorbing new knowledge and applying it to existing practices. All participants suggested that a mentoring network was potentially advantageous; however, problems were encountered when trying to match mentors and founders. In nearly half (thirteen) of the firms interviewed founders had chosen not to use a mentor and where a mentor had been assigned the experience had been mixed. In five cases the mentor had proved to be of significant value to the firm and had assisted in accessing customers, raising money or providing credibility in the market place. In four firms founders found the mentor helpful, particularly when new knowledge was being acquired and assimilated – *'at the start there were a lot of things going on and a lot of people prepared to give advice X (the mentor) listened a lot, but just talking it over helped me'* (founder four). A significant minority, five firms, did not find the mentoring experience worthwhile and the reasons for this were explored. Founders did not question the quality of the mentors but expressed disappointment in their contribution, for example the failure to provide appropriate contacts, have ready solutions to problems, or *'to get their hands dirty'*. The mentors interviewed perceived their role more as a sounding board, offering suggestions where appropriate and some soft introductions to personal networks if the idea was sufficiently formed. This dichotomy of opinion is perhaps linked to a failure to manage founders' expectations of the mentoring process. The problems identified in the mentoring relationship highlight the complexity involved in building trust and the difficulties posed when attempting to combine existing and new knowledge that create lead times in its exploitation. It is perhaps these lead times that allow frustrations to develop between parties and the breakdown of some mentoring relationships.

The integrated and holistic role played by the incubator directors in supporting transformation and exploitation is the 'glue' that actually holds the process together. These individuals are the first people that the prospective founders come into contact with and, from that point onwards, the founder and incubator director meet on a regular basis. Over time, therefore, the incubator director becomes embedded in the firm, knowledgeable of its historical development and of the progress the founders had made. Similarly, the founders had shared their trials and tribulations with the incubator director, both personal and business related, and this was regularly referred to – *'X (incubator director) has been a constant, he's seen the good times but he's been there when it's been very, very bad'* (founder nine). It is this regular and consistent interface that leads to the close association between the founders and the incubator directors. This is enhanced when interventions lead to positive outcomes, the business planning process, introductions to mentors and external business support personnel, access to review panel's and individual meetings. No one activity is the 'turnkey' solution,

the activities combine and reinforce each other and collectively assist founders to acquire, assimilate and transform new knowledge to enhance absorptive capacity and strengthen the business model of new technology firms.

## **Discussion**

The findings described here suggest that the process by which potential absorptive capacity is realized is of a contextual nature. As such, founders need to recognize gaps within their knowledge, receive apposite support to address these gaps and finally, through learning, apply their enhanced competencies to the management of the firm. Incubation, therefore, has the capacity to inform the business development process in contexts where founders, advisors and mentors effectively collaborate to build absorptive capacity. There are two integral elements to this process working effectively. Initially, founders have to be open to suggestions and ready to accept support; it is suggested that this willingness to engage in business development originates from earlier interactions with the incubator director at the entry stage where demonstrations of technical competence instilled confidence and fostered good relations. Moreover, such collaboration required an interrogative stance for it to be effective; so, it necessitated founders to critically review their proposals, develop detailed business plans and defend their ideas before expert third parties. Accordingly, founders are obliged to generate a reflexive appraisal of strengths and weaknesses. In so doing, knowledge gaps are revealed but, within the incubation context, the resources to address such gaps can be accessed. Understanding the need to acquire new forms of knowledge was, according to the incubator directors, the most difficult element of this process. As such, their key role was to guide founders towards appropriate sources of information; this was achieved in a number of ways. First, incubator directors provided information themselves or would signpost towards other advisors; second, they actively facilitated and supported the knowledge acquisition process so it could be effectively absorbed by founders. Finally, they supported founders in using their new found information.

Founders also had the opportunity of exploring how the value of recently acquired knowledge could be most appropriately applied through discussions with mentors and exchanges during the business review panels. Both of these activities allowed founders to reflect upon their proposed strategies and test them upon expert assessors. The assimilation and transformation of new knowledge was presented as a dynamic process that involved experimentation, trial and error. Whilst founders were subject to a diverse variety of advice, the incubator director helped to sift through, filter and make sense of these multiple strands of information - integrating the commercial advice with the proposed technology and so, enabling the generation of workable strategies to develop an appropriate business model. In effect, this process - whereby founders worked collaboratively with incubator directors, professional advisors and mentors - was critical in enabling the process by which good technological ideas were turned into viable ventures. Thus, founder exposure to multiple sources of critical appraisal plus, guidance towards resources to address identified knowledge gaps informed the journey from potential to realized absorptive capacity. This supports the findings made in the work of Simonin (1999) and Gupta and Govindarajan (2000) which suggests that the frequency of interaction and the quality of information are important factors in the successful transfer of knowledge.

Consequently, the UTBI created an environment which emphasized a critical relationship in technology led firms fostering the acquisition and implementation of managerial knowledge

to support business development. As such, knowledge acquisition and exploitation was embedded within the business development process through the effective use of an internal and external network of experts and advisors. Through this network, founders were able to access and share a pool of information; guiding this process were the incubator directors who drew upon their situated experience to steer them towards appropriate advisors. Incubator directors accumulated this experience from exploiting information gained during engagements with the firms which passed through the incubator and the networks generated during this process.

Having encouraged and facilitated the collection of information from a range of sources, the key element within the incubators studied here is the support offered which assists founders to assimilate and transform new information into something that can usefully be applied to support business development; this may include facilitating the appointment of a third party and embedding them as a member of the management team. This is achieved by encouraging founders to reflect on the knowledge acquired; this can be achieved on a one-to-one basis with incubator directors and mentors or within the broader context of a review panel. It is this reflective activity that enables founders to make sense of new information to understand how it can be assimilated with knowledge already held within the firm and transformed to support the business development process. Furthermore, this reflective process informs the need to obtain further information, as such the incubator activity studied is a recursive process, it unfolds over time enhancing absorptive capacity, strengthening the business model and supporting the commercialisation of new technology.

In summary, the argument presented moves away from the supply side perspective (Smilor, 1987; Hacket and Dilts, 2004; NESTA, 2008) and argues that a more holistic view is required which stresses the importance of the founder's willingness and ability to actively engage in an interactive, critical and reflective process. The paper goes on to highlight that, even within the context of UTBIs and the development of technology firms, deficits within the business model and managerial competence are key issues that must be recognized by founders if such weaknesses are to be addressed. The development of technical knowledge did not appear to be a key element of the incubation process for most firms studied and this is in line with the findings of Rice and Mathews (1995) and Studdard (2005). However, the ability of the incubator director to demonstrate to founders a technological understanding of the concepts that underpinned the commercial idea proved significant in their willingness to seek out advice and to engage in a reflexive process. Adopting a reflexive critique enabled the identification of key strengths and weaknesses and critically, enabled founders to identify those who could enhance their knowledge base to address such gaps and build absorptive capacity relating to managerial competence and business development skills.

## **Conclusions**

This paper has suggested that within young, technology ventures entrepreneurial opportunity recognition is evident through the generation of new products and processes. However, to successfully develop a business from these innovations, firm founders must absorb but also, appropriately exercise managerial knowledge and expertise. Evidence (Rice, 2002; Hughes et al., 2007) indicates that a critical stumbling block within the technology business development process lies in the gap between the entrepreneurial and managerial skills of technology ventures. Accordingly, this paper has explored to what degree university technology incubators can assist firm founders to recognize managerial shortcomings and

effectively accrue the required knowledge and skills to address such gaps. This has been framed through a processual analysis using the notion of potential and realized absorptive capacity.

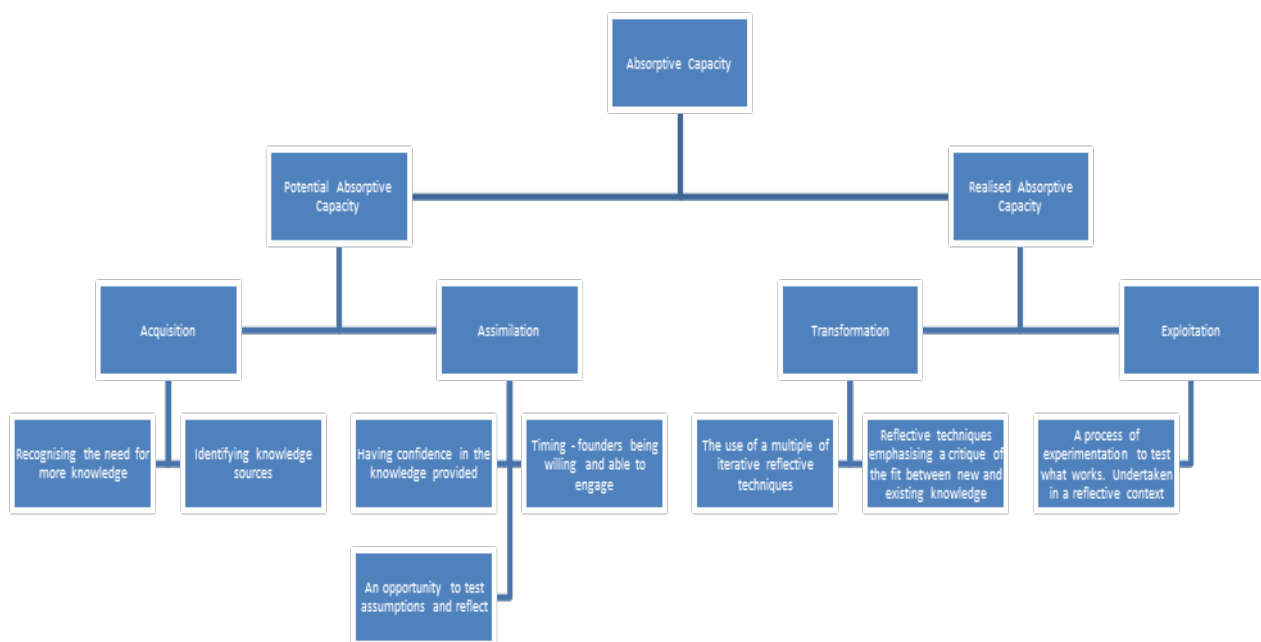
This paper recognises that whilst the potential for incubation to provide tacit support for early stage ventures is quite convincing, the degree to which they positively benefit the acquisition and exploitation of knowledge transfer and importantly, the managerial skills to exploit this process is less certain (Hacket and Dilts, 2004; NESTA, 2008, Scillitoe and Chakrabarti, 2010) The analysis presented commences with the premise that advantages from incubation cannot be assumed on the basis of a generic set of resources being made available to new ventures. Rather, this paper takes a processual view which points to the fact that translating learning into knowledge to realise absorptive capacity is not, and cannot be a unilateral process; but, in fact, has to capture a participative, interactive, and iterative relationship to be effective. Creating this context is significant and requires considerable effort on behalf of the incubator directors, to build confidence, provide access to information, facilitate opportunities for reflection and contribute to the transformation of knowledge into something exploitable. It is this context, constructed over time, which is evident in the incubators studied. It is therefore, suggested that one reason that the extant literature has failed to link incubation to improvements in the performance of new ventures arises from a lack of in-depth qualitative work which teases out this processual contextual relationship which strengthens the business model by enhancing absorptive capacity.

The paper also identifies that, within this context, the importance of iterative, reflexive and critical learning loops that supports the transformation of knowledge into something that can be meaningfully utilised and applied to exploit such proposals. It is the interaction between incubator directors, mentors and business support agents which enable experiential and exploitative learning, which are the precursors of knowledge accumulation. These interchanges lay the foundations for a reflective process that helps assimilate new knowledge into the body of understanding that exists within firms and their founders. The paper therefore, develops the incubation construct theoretically and illustrates how absorptive capacity can be dynamically activated in contexts which facilitate collaborative interchanges that facilitate knowledge acquisition, assimilation and transformation. This is congruent with the notion that absorptive capacity and learning have a recursive relationship (see Sun and Anderson 2010) i.e. is cumulative and builds over time with learning; increasing the knowledge base and the potential to absorb further knowledge. The final element of absorptive capacity is exploitation; early stage technology firms face a very uncertain and complex economic environment, so, the positive benefits of incubation can only be realized if new products and processes can get into the market. Yet, should the market not be conducive to a particular product or idea, founders would at least be better equipped to develop a business around future technological ideas.

This research is both limited and liberated by the sample which informs the paper; by focusing upon two incubators the empirical findings are not generalisable however, this is not the intention. Through detailed interviewing spanning all those involved with the incubation process this paper has developed an in-depth analysis of how an incubation process can enhance absorptive capacity to support the development of early stage technology firms. In so doing, three issues not well rehearsed within the extant literature are highlighted that could help inform future studies and assist practitioners in the field. Firstly, when analyzing the advantages of incubation, the focus has largely rested upon the physical resources available within the incubator, the availability of professional advice and the components of the

business development programme. Within this scenario, the engagement of founders is assumed yet, as argued in the paper, this cannot be taken as a given but must be actively generated. Indeed, the willingness and ability of founders to engage in the process is a key factor within the effective operation of an incubator. Accordingly, future research needs to investigate how the incubation process creates a context which encourages and empowers founders to proactively engage with those who can effectively assist and inform the accumulation of the knowledge essential to develop a commercial business model. Secondly, in technology led firms, it would seem that the ability by an incubator director to demonstrate technical competence helps to instil confidence within owner-managers as to abilities of the director and the knowledge and information that they provide. Finally, the paper highlights the importance of reflection to knowledge assimilation and exploitation arguing this to be a dynamic recursive process. Future research needs to concentrate upon these dynamic practices that enable founders to combine new and existing knowledge and in addition, those mechanisms which might assist them to apply this to their ventures. In so doing, the added value of incubation will be more clearly demonstrated whilst the viability of new innovative ventures will be enhanced.





## Appendix One: Building Absorptive Capacity within the Context of Incubation

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