

# EXPLORING HOW RESOURCE ALLOCATION ROUTINES INHIBIT THE PURSUIT OF DISRUPTIVE INNOVATIONS AS A ROUTE TO CORPORATE ENTREPRENEURSHIP

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## ABSTRACT

Given the corporate pursuit of discontinuous and breakthrough change, we work to deconstruct and shed understanding on managers' failure to formally allocate resources to entrepreneurial activities that seek to deliver disruptive innovations. Using an interpretivist approach with field data from two primary and four secondary cases, we show that managers' failure to recognise the restrictive impact of their mental models – their implicitly held images and beliefs – regarding the goals of innovation and organisational development will lead them to reject opportunities with disruptive potential. We design and implement a graphical Portfolio Management intervention to expose and overcome these maladaptive behaviours and find that managers employ up to five different 'disruptive innovation rejection strategies' when innovation opportunities are incongruent with dominant mental models. The rejection strategies are observed to be driven by the psychologically uncomfortable emergence of 'cognitive dissonance'. We further ground the data in the often neglected literature from social psychology's cognitive dissonance theory to generate implications for business leaders, instigating an innovative stream of research for those interested in further enhancing our understanding of the entrepreneurial pursuit of disruptive innovations.

## INTRODUCTION

Corporate entrepreneurship (Burgelman, 1983) aiming to produce discontinuous innovations that disrupt and re-shape the exiting terms of economic engagement in established industries can provide firms with an opportunity to create substantial long-term value (Abernathy and Clark, 1985; Carrol, 1985; Christensen, 1997; Timmons, 1999; Walsh and Kirchhoff, 2002). However, most managers overlook or ignore their emergence, focusing instead upon innovations that offer incremental or at best radical improvements to the performance of existing economic goods that lead customers (McDonald et al., 2001) desire and expect (O'Connor and Rice, 2001; Rothwell, 1995; Christensen, 1997; Timmons, 1999). Moreover, of those companies who have disruptively entered new markets (e.g. Apple i-Pod in digital music) or began as industrial

discontinuities (e.g. easyJet in the European airline industry), almost none are able to systematically introduce further disruptions (Christensen and Overdorf, 2000; Kassicieh et al., 2002; Hamel, 2000). Indeed, understanding the way firms can successfully manage discontinuous forms of corporate entrepreneurship is not well understood (Acs and Audretsch, 2003). Our objective is to help business leaders of established firms to improve their management of non-sustaining innovation processes, in particular for the pursuit of 'disruptive innovations' as defined by the likes of Christensen (1997), Christensen and Bower (1996), Gilbert and Bower (2002) and Danneels, (2004).

The current research focuses on resource allocation routines – since they have been identified as one of the key barriers to successfully developing and exploiting entrepreneurial opportunities that conflict with tradition or with established market and business norms (Cooper et al., 2001; Chandy and Tellis, 1998; Tushman and Anderson, 1986; Thomond, 2004). The entrepreneurship, new product development, strategic management and psychology literatures highlight how managers' cognitions and 'cognitive inertia' can negatively impact business operations (Ahuja and Lampert, 2001; DeBono, 1968 and 1988; Kiesler and Sproull, 1992; Leonard-Barton, 1992); and recent attempts have been made to locate an organisation's lack of flexibility to support corporate entrepreneurial activities, such as disruptive innovation, in the restrained cognitive processes of senior managers (Tripsas and Gavetti, 2000; Kaplan et al., 2003). Indeed, there is an emerging call for a better understanding of the impact of managerial cognitions upon the pursuit and delivery of non-sustaining innovations (Tripsas and Gavetti, 2000; Kaplan et al., 2003; White and Bessent, 2004). Therefore, in studying the resource allocation routines of organisations, our approach is guided by the long tradition in social psychology of exploring the liabilities (and advantages) of 'mental models' (Minsky and Papert, 1969; Senge, 1990) and 'cognitive dissonance' (Festinger, 1957; Harmon-Jones and Mills, 1999). Of particular relevance to us is the how managers' existing and dominant cognitive patterns constrain the organizing of resource allocation configurations.

This article will firstly delineate disruptive from sustaining innovation. It will then provide a background to the topic of managerial cognition from the perspective of mental models and cognitive dissonance and highlight its pertinence to the topic of disruptive innovation. A three phase, 29-month exploratory investigation with six case studies will be described. It illustrates how the resource allocation issue was first investigated through interviews and workshops, then through a direct intervention based upon an adapted Portfolio Management approach, the use of which was justified by the results of the early phase of the research. The intervention aimed to overcome maladaptive resourcing behaviours within the two primary cases, whilst deconstructing managers' failure to allocate resources to entrepreneurial efforts that seek to generate disruptive innovation in an effort to generate new knowledge. Thus, our research aims to develop a better understanding of managerial cognitions that restrain resources to sustaining innovations and to provide insights and implications for managers on how they could overcome resource allocation barriers within their organisations in the future.

## WHAT IS DISRUPTIVE INNOVATION?

Following the lead of the Clayton Christensen's research (e.g. Christensen and Rosenbloom, 1995; Christensen and Bower, 1996; Christensen 1997; Christensen Overdorf, 2000; Christensen et al., 2001; Christensen and Raynor, 2003; Christensen et al., 2004) and Danneels's (2004)

clarifications of his definitions, our research frames a firm's entrepreneurial outputs into two camps: sustaining innovations and disruptive innovations.

Sustaining innovations offer incremental or radical performance improvements that lead-customers (McDonald et al., 2001) desire and expect (O'Connor and Rice, 2001; Rothwell, 1995; Christensen, 1997); however, occasionally revolutionary breakthroughs occur with a discontinuous impact upon this steady state (Christensen, 1997; Dosi, 1982; Schumpeter, 1975). Many discontinuous innovations are still sustaining in nature as they offer revolutionary leaps forward in performance improvement in the directions that lead-customers desire, yet break the steady-state as they are not expected to be possible (Christensen, 1997; DeTienne and Koebig, 2002). Conversely, there is a type of discontinuous innovation that we (like Christensen) term 'disruptive innovation': a customer offering (economic good) based upon one or more new technologies and/or processes that has enabled the introduction of new product/service attribute sets, which in turn have changed the basis of competition within a market by changing the performance dimensions along which organisations compete (Thomond, 2004). Potentially disruptive innovations can therefore be viewed as threats to the prevailing status quo or opportunities for new forms of wealth creation (Danneels, 2004). This article focuses upon managers' pursuit of disruptive opportunities within established firms.

Christensen's work proposes that there are two approaches to the delivery of disruptive innovation: 'new-market' and 'low-end' strategies. A new-market disruption is initiated through the launch of a radically new offering for 'non-consumers'. Non-consumers are people who have historically lacked the skill or money to buy and use the mainstream offering of the market place. Through a process of sustaining innovation and niche marketing, the new-disruptive offering eventually migrates into the traditional commercial space of existing industries. For example, consider eBay's introduction of an auction facility to a new-market of customers who previously did not consume such services; and also consider eBay's impact emerging on traditional auction houses. A new-market disruption therefore generates new-net-wealth from ignored customers on the way to entering and disrupting an existing market (Christensen and Raynor, 2003). Alternatively, a low-end disruption is initiated through the launch of a poorer performing offering for low-demanding customers that have been traditionally overlooked and oversupplied by the existing market incumbents. Though simpler, the low-end offering introduces new performance dimensions to entice low-end customers, in doing so investments are made into sustaining innovations and the offering eventually migrates upstream to disrupt the existing market structure (Christensen and Raynor, 2003). For example, consider how Canon introduced simple table and desk-top photocopiers into small and medium sized enterprises, their simpler technology eventually migrated upstream as a low-end disruption to Xerox's control of the high-speed photocopying industry. Similarly, some new ventures can adopt both approaches, as the strategies are not mutually exclusive a firm that starts with a new-market focus may later adopt a low-end entry point in an adjacent mainstream market. Disruptive innovations are therefore characterised by the development of customer offerings that do not concentrate on the trajectories of development along which the market leaders traditionally compete. As such, managers who exploit disruptive innovations will, and only if they are willing to be 'be patient for growth but impatient for profitability' (Christensen, 1997; Christensen and Raynor, 2003), be able to drive a disruptive niche marketing strategy that is under-valued by traditional lead

customers and overlooked by industry incumbents, yet eventually able to reshape the existing terms of economic arrangement in established industries.

There are many different typologies and views points regarding the dualistic goals of innovation, of which Christensen's perspective is just one (Danneels, 2004). Regardless of the differences in vocabulary and definitions used by other authors, researchers understand that the development of innovations that disrupt and re-shape the exiting terms of economic engagement in established industries can provide firms with an opportunity to create competitive advantage and substantial long-term value (Acs and Audretsch, 2003; Ali, 1994; Gilbert 2005; Tushman and Nadler, 1986, Christensen, 1997). Moreover, researchers show that the development of these discontinuities require very different strategies and processes from innovations that enhance and sustain the status-quo (Dewar and Dutton, 1986; Ettlie, Bridges and O'Keefe, 1984; Kassicieh et al., 2002; Veryzer 1998). Researchers have also repeatedly shown that industry incumbents are mostly unable to generate, foresee or respond to discontinuous technological or commercial changes (Hannen and Freeman, 1977 and 1984; Johnson, 1988; Henderson and Clarke, 1990; Christensen and Rosenbloom, 1995; Tushman, and Anderson, 1986). Indeed, understanding the way firms can successfully manage non-sustaining innovation processes is of interest to both academics and industrialist alike.

### RESOURCE ALLOCATION, MENTAL MODELS AND COGNITION

Ansoff's (1965) notes that "... entrepreneurially orientated managers would view the firm as a pattern of investments [options to which resources can be allocated] to be amended and changed when better opportunities arise." (p131). Despite this logical and calculating explanation of resource allocation, managers do not always act this rationally even when they see disruptive change on the horizon (Johnson, 1988). The Polaroid Corporation, was a world-leading producer of photography equipment from 1947 to 1997, yet it filed for Chapter 11 bankruptcy in October 2001. Tripsas and Gravetti's (2000) analysis of the Polaroid case reveals that the primary reason for the collapse of the business was the top management team's failure to embrace digital photo storage technology and their embedded ties to the technologies and business models that had delivered past success. The path dependent nature of Polaroid's business development was found to be nowhere more evident than in its corporate executives' decision-making processes. Despite the fact that a team of Polaroid's technologists had developed competencies in digital technologies the firms' leaders failed to allocate significant resources and support: "Polaroid's difficulties in adapting to digital imaging were mainly determined by the cognitive inertia of its corporate executives." (Tripsas and Gravetti, 2000:1159). Cognitive inertia had trapped Polaroid's executive team into a focus upon the status quo that had prevailed for so long (Tripsas and Gravetti, 2000), leaving the whole organisation vulnerable to the destructive forces of disruptive innovation. Thus, how managers allocate their time and resources is a complex dynamic, which is compounded further by its diffusion throughout all levels of the business, making resource allocation a difficult issue to manage and understand in general (Dougherty and Hardy, 1996), particularly when trying to foster the pursuit of disruptive innovation.

Many researchers "...are starting to see how the choices we make are swayed by a complex range of factors such as emotions, social context and uncertainty... [in fact] when we weigh up the cost and benefits of various courses of action, we do not just consider the material gains but

also the social and emotional ones” (Spinney, 2004:32-33). Understanding of these less rational decision-making mechanisms has been fruitfully extended by those contributing to the study of ‘mental models’ (Minsky and Papert, 1969; Papert, 1980), which are individually or socially constructed psychological tools that people use to construct, deconstruct and utilise knowledge (Senge, 1990). Teams will often share mental models that are built upon the common elements of each individual’s mental models, but also guided by the dominant top executives’ perspectives (Senge, 1990). Mental models act as maps, at either the team or individual level, that help people to process information at faster rates, yet they also determine and influence the level of importance that is placed upon incoming information (Swan, 1997). Consequently, a strength of mental models is that they enable people to create rapid and penetrating insights but a limitation is that in creating ways of seeing, they can also distort perspective and create ways of not seeing (Senge, 1990; Kiesler and Sproull, 1992). The notion that humans use mental models to assist with information processing leads us to the conclusion that “... the way we see our options can colour the decisions we make” (Spinney, 2004:35).

Dominant mental models and, by consequence, patterns of behaviour are influenced by organisational memory (Senge, 1990; Lukas and Bell, 2000; Olivera 2000; Walsh and Ungson 1991). For example, information and knowledge is said to be embedded within individuals, relationships, culture, processes, structures, archives and artefacts (Stewart 1998), all of these help to establish an organisational memory that influences decision-making (Senge, 1990; DeBono, 1988). Hence, when management practitioners recall information and knowledge from their organisations’ history, they are, in effect, drawing upon their organisational memory (Senge, 1990). DeBono (1968 and 1988) offers the construct of psychological inertia to explain how and why people get trapped into ways of thinking and being, thus finding it difficult to change. The effects of organisational memory can be paralleled to psychological inertia; both, it would seem, are important building blocks in an individual’s or teams’ mental models, therefore affecting day-to-day decision-making.

In sum, the notion of ‘mental models’ helps us to understand that people do not always behave congruently with their espoused aims; instead they behave congruently with their implicit, conscious and unconscious ‘theories-in-use’ (Argyris 1982). Thus, mental models can be used as a lens through which we can consider managers’ perceptions of resource allocation options and organisational bias towards sustaining innovations. For example, managers who anticipate dissonance between an opportunity and their established mental models are generally expected to react to minimise or completely avoid the perceived potential cognitive discomfort that this conflict is likely to generate (Senge, 1990; Kiesler and Sproull, 1992; Harmon-Jones and Mills, 1999). ‘Cognitive dissonance’ (Festinger, 1957) could therefore explain why potentially disruptive innovations fail to garner organisational support because they are incongruent to the prevailing dominant mental models of the individuals with strategic resource allocation responsibilities. For example, the case of the Polaroid Corporation’s failure to embrace disruptive digital technologies illustrates the power of strong, deeply held mental models, especially those of an organisations top management team. Thus, a management team’s bias towards the status quo could be seen as a consequence of ‘cognitive dissonance avoidance’ (Festinger, 1957; Harmon-Jones and Mills, 1999), where individuals actively avoid cognitive dissonance by attaching new values to the concept that is incongruent with their mental model, in order to generate a false assessment of

the actual value of that concept (Festinger, 1957). The result is the rejection of incongruent ideas in an attempt to alleviate the presence of potential or perceived unwanted conflicting emotion (Harmon-Jones and Mills, 1999). Thus, mental models may not only generate a skewed perception that underpins the failure to see the disruptive potential in a new concept but they may also be a major psychological cause for the rejection of potentially disruptive innovations: "...many of the best ideas never get put into practice... because they conflict with deeply held internal images of how the world works, [as mental models are] images that limit us to familiar ways of thinking and acting" (Senge, 1990:174).

The aim of this article is to present research that offers an enhanced understanding of resource allocation approaches that fail to support disruptive innovation as a route to corporate entrepreneurship. Of particular interest is the impact of mental models and management cognitions within this process. We demonstrate that prevailing mental models limit managers' freedom of action and cause them to reject disruptive innovations. An intervention was designed to help managers overcome this maladaptive behaviour and implemented within two primary case study organisations. An evaluation of the impact of the intervention is offered at two levels. Firstly, performance changes observed in the cases are presented and secondly, the insights garnered into restrictive resource allocation routines and their links to managerial cognition are discussed. Our objective is therefore to help managers to improve their management of non-sustaining innovation processes and to develop insights that will address outstanding gaps in the literature regarding managerial cognitions that restrain organisations to the pursuit of sustaining innovation.

## METHODOLOGY

In response to calls from the Academies of Management in America and Britain for research that is both academically rigorous and relevant to business practitioners (e.g. Huff, 2000; Tranfield, 2002), this research takes advantage of a collaborative academic-industrial approach inspired by the 'action research' (Reason and Bradbury, 2001; Coughlan and Coughlan, 2002) and 'Mode 2' strategies (Huff, 2000; Tranfield, 2002). Our objective is to develop and validate ways to help companies to overcome the 'resource allocation problem' whilst delivering a better academic understanding of the reasons for the problem in the first place. Over three research phases, we employed a multi-case design (Yin, 1994; Eisenhardt, 1986) using an action research approach for purposes that are best described as 'theory elaboration' (Lee, 1999), in that we elaborate theoretical links not previously explored in depth within the literature. "The grounded, iterative, interventionist nature of action research ensures closeness to the full range of variables in settings where those variables may not emerge all at once" (Westbrook, 1995:18), it is, therefore, a suitable and justifiable epistemological and methodological approach for the investigation of resource allocation routines and their context bound nature.

### Case Selection

The current research does not aim to replicate previous studies; instead it aims to elaborate existing theory by generating new understanding. Thus, theoretical categories were established to focus case selection (Glaser and Straus, 1967). The categories were based upon a series of polar types underpinning the notions of the research topic (Eisenhardt, 1989; and Silverman, 1999)

and therefore included:

- a polar axis to represent of large, medium and small sized enterprises (definition, taken from the European Commission (2002));
- a polar axis to differentiate between service providers versus manufacturers;
- criterion to ensure firm maturity and explicit desire for discontinuous change (selected as we were examining the pursuit of corporate entrepreneurship within established firms)

Consequently, six cases were selected, the names of which have been disguised because of the sensitive and confidential nature of the data; all were mature firms communicating an intent to deliver breakthrough innovations: 1 x small manufacturer (Case A); 1 x large manufacturer (Case B); 2 x small expert service providers (Cases C and D); 1 x large service provider (Case E), 1 x large provider of services and manufactured goods (Case F). Cases A and B, the two pure manufacturers, were selected as the primary cases as the innovation literature is skewed towards the manufacturing sector (Grandstand, 2000), providing the authors with a deeper repository of knowledge from which to draw and contribute. Although such qualitative case study research is limited to generating context-specific grounded understanding, highlighting issues of great relevance to those involved but without grounds for statistical generalization, the embodiment of a broad population of cases aids with the generality demanded by the research topic.

### Overview of research process

The process of conducting action research can be summarised into six key stages – data gathering, data feedback, data analysis, action planning, intervention, evaluation – and one meta-stage of continuous monitoring and feedback throughout the entire process (Reason and Bradbury, 2001; Coughlan and Coughlan, 2002). The current research integrated these six features into three phases. The objectives of Phase 1, completed in two months, were to generate a broad understanding of the issues faced by managers regarding the allocation of resources to disruptive innovations and to understand the types of interventions (or management tools) that may be more readily accepted by the firms involved in the research (Table 1). French and Bell (1990) illustrate that findings and data from rigorously designed research can be formed into corollaries and specifications for management interventions. “[I]nterventions are sets of structured activities in which selected organizational units (target groups or individuals) engage in a task or a sequence of tasks where the task goals are related directly or indirectly to organizational improvement. Interventions ... make things happen” (French and Bell, 1990:113). The action research approach enables researchers to implement management interventions, using knowledge and insights gained from their investigations, therefore permitting them not only a unique opportunity to collect new data but to witness first hand the relevance of their research (Reason and Bradbury, 2001; French and Bell, 1990). As such, it was decided that if a management intervention, which embodies the findings of this investigation, could be implemented with positive affect, then the knowledge generated could be said to offer industrial utility and justified theory elaboration. Thus, the objectives of Phase 2, completed over nine months, were to design and implement a management intervention to enhance the understating of the resource allocation practices within the primary cases and to assist the participants to tackle their resource allocation barriers (Table 2). The objectives of Phase 3 were also two-fold. Firstly, to assess and understand the intervention’s influence and industrial utility, monitoring it both immediately and over an initial period of

18 months. Secondly, we aimed to enhance understating and elaborate theory regarding the resource allocation barrier. Thus, the final phase involved dissecting and analysing the resource allocation routines of the primary cases and sharpening conclusions by obtaining and considering confirmatory and disconfirmatory data by presenting this analysis to the secondary cases and enfolding relevant literature. These objectives enabled us to build insights and management implications in response to an improved understanding of the underlying drivers that inhibit resource allocation routines and the pursuit of disruptive innovations (Table 3).

**Table 1: The multiple forms of data collection activities utilised in Phase 1 of the research and the objectives of these activities.**

CASES INVOLVED	DATA COLLECTION TECHNIQUE	OBJECTIVES
Case A, B, C, D, E, and F	1 x face to face exploratory, semi-structured interviews with at least one executive manager from each case regarding resources allocation and the pursuit of disruptive innovation	To build initial understanding of funding barriers within each case and to agree the research process.
Case A, B, C, D, E, and F	1 x three-day multi-organisational workshop focused on discussing the issue at hand, 18 participants in total.	To better understand barriers to resource allocation and to generate a view from managers of solutions/invention procedures that would be accepted within the firms.
Cases A and B	2 x semi-structured telephone interviews with each primary case; plus numerous informal email communications.	To gather in-depth data and present initial findings in order to iteratively focus on the roots of the resource allocation issue.

**Table 2: The multiple forms of data collection activities utilised in Phase 2 of the research and the objectives of these activities.**

CASES INVOLVED	DATA COLLECTION TECHNIQUE	OBJECTIVES
Case A	1 x two-day workshop with senior executive team (5 participants), including tour of site; plus numerous informal email communications.	To deliver more detailed understanding of resource allocation barrier and individual preferences/requirements for solution types; and to present ideas for an intervention format.
Case B	2 x Telephone conferences with senior managers and engineers (4 participants in total); plus numerous informal email communications.	
Case A	1 x one-day innovation project assessment exercise (completed by senior management team using a pro forma deigned by the researchers).  1 x two-day workshop with senior management team (5 participants), plus the gathering of immediate post intervention feedback from participants.	To implement a resource allocation intervention that will deliver a better understanding of resource allocation barrier to disruptive innovation and to improve the participants' ability to overcome this obstacle.

Case B	<p>1 x two-day innovation project assessment exercise (completed by senior management team using a pro forma designed by the researchers).</p> <p>1 x one-day workshop with senior management team (16 participants), plus the gathering of immediate post intervention feedback from participants.</p>	To implement a resource allocation intervention that will deliver a better understanding of resource allocation barrier to disruptive innovation and to improve the participants' ability to overcome this obstacle.
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**Table 3: The multiple forms of data collection activities utilised in Phase 3 of the research and the objectives of these activities.**

CASES INVOLVED	DATA COLLECTION TECHNIQUE	OBJECTIVES
Case A and B	Written presentation of initial analysis to the primary cases.	<p>To conduct in-depth follow-up analysis.</p> <p>To ensure no researcher bias of the evaluation.</p> <p>To confirm and validate the insights and implications drawn from the researcher-led interventions within a broader organisational context and within the literature.</p>
Cases A and B	3 x semi-structured telephone interviews with members of cases A and B (3 months, 6 months, 9 months and 18 months after the interventions); plus numerous informal email communications.	
Cases A, B, C, D, E, and F	2 x 1 hour presentations regarding the intervention from senior managers of cases A and B to the authors and senior members of Cases C, D, E and F (2 months after the interventions)	
Cases A, B, C, D, E, and F	1 x 1-day multi-organisational workshop to discuss the intervention, the insights generated by the authors and to clarify, analyse and discuss the implications (2 months after the interventions); plus numerous informal email communications.	

### Data Analysis

All interviews were transcribed, documents and emails were recorded and all workshops were minuted and confirmed as correct representations of the order of events by all participants involved. The entire data set was entered into a case study database to facilitate the analysis and coding exercise. Data collection, data analysis, and conceptualization have been iterative (Glaser and Strauss, 1967; Eisenhardt, 1989). The data were analysed using qualitative data analysis methods proposed by Miles and Huberman (1994), Strauss and Corbin (1990) and Glaser and Strauss, (1967). Initially, a simple analytical frame was formed of a primitive, stereotypical resource allocation process, using existing literature. The simple frame enabled the data to be grouped into simplistic arrays and analysed using a cluster methodology (Silverman, 1999). The clustering enabled the lead author to identify common themes from which a more advanced grounded coding system was built. The themes were extended with further data collection which was only stopped when a level of saturation was reached (Glaser and Strauss, 1967; Eisenhardt, 1989). A second reader, who was blind to the original coding approach, cross-checked the data, at no

point was there discord between the second reader's coding or the original coding. Early insights, based upon within-case and cross-case analyses (Eisenhardt, 1989) were enhanced through the enfolding of literature, following methods for inductive theory development (Glaser and Strauss, 1967; Eisenhardt, 1989) and were then presented to managers from all six cases. Exposure of the emergent thematic structure and initial conclusions to the collaborating cases allowed further confirmatory and disconfirmatory perspectives to be absorbed; this enhanced and sharpened the findings. The current article focuses upon the recurrent themes that were elicited from the data regarding the rejection of potentially disruptive innovations, in particular the cognitive processes attributed to such acts.

### INVESTIGATING RESOURCE ALLOCATION: INITIAL FINDINGS AND THE DEVELOPMENT OF A PORTFOLIO BASED TOOL TO FURTHER PROBE MECHANISMS AND MINDSETS

The data analysis from the early phases of the research revealed that senior managers' from each of the case studies reported perceived inadequacies in their current resource allocation routines that were primarily attributable to a problem of cognition rather than one of process (of the 7 primary disabling influencers identified all reflected this fact). In fact, senior participants from each case recounted times when they had been presented with opportunities with disruptive potential and during these reports there was often little attention given to financial or formal mechanisms. Indeed, the managers mostly focused on their recognitions and their 'feelings' of the existence of an inconsistency between the new opportunities and their current understanding of either the aims of innovation or their organisation. These 'inconsistencies' were reported to lead to 'feelings of uneasiness' and even resentment. The existence of such conflict created a cognitive driver to employ strategies to alleviate the dissonant feeling, which resulted in the rejection of the potentially disruptive opportunity. Furthermore, analysis of the data from Phase 1 and the first stage of Phase 2 revealed an additional six themes regarding potential approaches for overcoming inappropriate resource allocation routines.

All these insights and themes were combined into corollaries representing idealistic specifications for a management intervention that could possibly assist managers to challenge restrictive resource allocation routines. In sum, the initial phases showed that if managers could *see how* and *why* they inhibit the allocation of resources to disruptive innovations, then they will be in a better position to overcome their bias towards incrementalism. As it is claimed by seeing wholes we learn to foster health (Senge, 1990), it was agreed with the managers that a visual tool, which can deliver 'holistic understanding', should form a large component of the intervention. Thus the intervention needed to expose and explain the prevailing mental models that were at the root of the management teams' resource allocation barrier and enable them to see differently.

Portfolio Management (PM) is a recognised and trusted graphically based management approach; it dominates both academic discourse and leading practice as a mechanism to improve the effectiveness of resource allocation for innovation (Cooper, 1999; Hamel, 2000; Cooper et al. 2001). Despite the clear advantages of using PM techniques for innovation generally, PM methods, in their current form, are not adequately developed to encourage the allocation of resources to non-sustaining innovations (Christensen 2003) and can restrict managers from investing into both small and globally emerging opportunities (Burgelman et al, 1996). However, it was agreed

with the senior management from the cases that PM techniques, if adapted, could be designed to meet the specifications of the intervention as described above. Thus, our research explored the adaptation of PM techniques for the pursuit of disruptive innovations; an intervention process was developed and called the Disruptive Portfolio Management (DPM) approach. Like other portfolio approaches, the DPM was designed to provide an holistic understanding of innovation activity. However, unlike other portfolio approaches, the DPM integrates a state of the art understanding of disruptive innovation. It was designed to enable participants to understand why disruptive opportunities had not been easily financed in the past, and to help justify investment into potentially disruptive projects in the future.

The authors designed and prepared an innovation project assessment process called the dimensions ranking checklist (DRC); it was founded upon a series of questions and presented in a questionnaire format. Although the managers in all six cases traditionally favoured financial measures for assessing innovation initiatives, a concentration upon financial measures delivers the worst performing portfolios (Cooper et al, 2001). Therefore, the DRC had two objectives, the first of which enabled the managers to assess individual innovation initiatives on a range of standard Portfolio Management measures, plus a cluster of qualitative and quantitative measures focused upon disruptive innovation, in order to gauge the 'disruptive potential' of the initiatives under consideration. Secondly, the DRC could be used to assess individual innovation initiatives at varying stages of maturity, from an early stage idea/concept to an advanced innovation project. The checklist could be completed as 'homework' by the relevant senior managers. When the approach was implemented in Cases A and B, each management team selected at least 10 high priority innovation projects, and a small selection of recently 'killed' initiatives for assessment with the DRC. The DRCs were utilised in an innovation project assessment session within each case, these lasted one day and two days in cases A and B respectively. The output from the completed checklists was mapped onto seven large scale portfolio maps or "Bubble Diagrams" (Cooper et al, 2001), where projects were plotted on 1m<sup>2</sup> X-Y axes against different parameters such as degree of technical risk, degree of commercial newness and so on. Four of the maps were standard portfolio management views and three were designed to specifically account for disruptive innovation. The aim was to present to each of the senior management teams an holistic graphical representation of their portfolio of high priority innovation projects. A DPM workshop was therefore designed to introduce the concept of disruptive innovation to the full senior management teams with responsibility for innovation strategy and resource allocation. The participants were then facilitated through a review and discussion of the data presented on each of their seven portfolio maps and encouraged to consider the future of their innovation strategy. The workshops lasted one day and two days in cases B and A respectively.

## OVERCOMING AND UNDERSTANDING RESOURCE ALLOCATION BARRIERS

### **An adapted portfolio approach may help overcome a bias towards sustaining innovation: the impact of the intervention**

The management teams in both cases reported that they now have, for the first time, a holistic understanding of the entire 'innovation playing field' – ranging from sustaining to disruptive innovation. Immediately following the intervention, the teams stated that they felt convinced about the importance of disruptive strategies and felt that they were more enabled to legitimise

the allocation of resources to the pursuit of disruptive innovation; both cases reported this to be the case, although case B to a slightly lesser degree in the 18 months that followed. Worthy of particular mention is the observation that the presentation of visual portfolio maps, when combined with the transfer of knowledge on disruptive innovation, generated an holistic view that enabled the managers from both cases to:

- see emerging patterns in their approach to innovation and force critical discussion as to why they observe a bias towards incrementalism,
- generate self-awareness regarding their dominant mental models on innovation in a pragmatic fashion, as opposed to being taught theoretically possible underpinnings for inappropriate resource allocation routines;
- prevent one person or one project from dominating the resource allocation debate;
- generate a better understanding of the weaknesses and strengths of their individual innovation projects, but more importantly to understand the overall picture and relationships of multiple innovation projects and their organisational bias towards sustaining innovations;
- actively consider investing resources into innovation projects with disruptive potential, especially when a disruptive innovation is not framed as ‘bet the company’ investment but rather a low-risk initially niche venture, where its managers are patient for growth but impatient for profitability and quick to respond to emergent market needs.

The management teams in both cases have continued the use of the portfolio approach; stating that it enables them to be significantly more focused on the task in hand in management meetings arranged to discuss innovation. The managing director of Case A summarised the feelings of the participants from both cases: “What we’ve delivered in these workshops in just a few days would have taken us weeks without your help, and we still wouldn’t have been able to see what was really happening”. This positive feedback was reiterated in follow-up contact two, three, six, nine and eighteen months after the interventions.

There were a number of case-specific observations that highlight the utility of the portfolio approach. Specifically, during the intervention Case A cancelled two projects and within two months three more had been cancelled or ‘frozen’. Each of these projects were set to deliver sustaining innovations and had been stopped because of the top management teams’ acceptance of the fact that their core customers were becoming increasingly unwilling to pay more for enhancements to existing products. The cancellation of these projects freed resources that were reallocated to concepts with perceived disruptive potential. Three of these potentially disruptive projects were, in fact, options that had been terminated under their previous resource allocation processes. Three months after the intervention, the managing director reported that the portfolio approach had saved them considerable time and money and had opened the significant potential for new revenue streams; after six months he estimated that the value of Case A’s portfolio had increased by 50%.

Performance changes occurred more slowly in the larger case, yet three months after the intervention within Case B, the R&D group of their leading division reported that it had

restructured its resource allocation arrangements. The division had ring-fenced 5% of their annual innovation budget for disruptive innovations and a further 20% for sustaining innovation projects of a radical nature. This funding was diverted from sustaining innovation projects that were set to deliver incremental improvements. The participants of the workshop continue to report that their improved understanding of disruptive innovation enables them to challenge biased resource allocation routines – although a recent organisational restructure has diluted the power of this group. In addition, follow-up interviews after 9 months revealed that the process underpinning the portfolio management intervention had been enhanced and adopted into Case B's quarterly strategic reviews of innovation. By month 18, they reported that their portfolio management approach kept them focused on a more diverse and more valuable portfolio of innovation than they had previously ever pursued.

### **The identification of five 'Disruptive Innovation Rejection Strategies': insights from the intervention**

The analysis of phase 2 and 3 data has generated a deeper qualitative understanding of the impact of managerial cognitions upon the pursuit of disruptive innovation via a better understanding of the resource allocation function. Five recurring themes emerged from the data, revealing managers' employment of five cognitive strategies, all used to reduce the uncomfortable feeling of dissonance that accompanies potentially disruptive innovations, leading to their ultimate rejection:

#### *Rejection Strategy 1 Rewarding incrementalism:*

It was observed in both cases that the prevailing explicit and implicit rewards had a negative effect upon managers' decisions to fund potentially disruptive opportunities (where explicit rewards include financial incentives and promotions, and implicit rewards include a sense of belonging and respect from peers (Unsworth, 2001; Amabile, 1997)). The rewards reduced creativity and caused management to disregard evidence which suggested that the resources within their organisation's existing and primary technologies or business models may be put to better use in opportunities differing to current practice.

For example, in Case B, it emerged that job creation was an important implicit performance measure that was rewarded by top management. Thus, the initiation of new product development projects for small niche markets, as characterised by disruptive innovations, gained little support in comparison to investment opportunities with familiar technologies that could generate immediate large scale job creation. In fact, in the 1990's, this implicit reward had driven Case B to incrementally increase the scope and quality of the specification of a contract with the US government. Consequently, when the customer cancelled the order, because of policy change and major technological over-supply, Case B suffered a significant setback. In Case A, explicit rewards were focused upon current production line enhancements – once again steering management's attention to incrementalism. Moreover, both cases A and B appeared to display an 'Emergency Room' culture (Allen et al., 1999), especially case A. This was characterised by the existence of implicit rewards for the ability to conduct 'rapid fire' analyses of situations, where judgements need to be made quickly, along with prompt action. When implicit rewards exist for reacting quickly, making fast assumptions and insisting upon quick action, there appears to be little

support for suspending judgement, building empathy for new ideas and nurturing potentially disruptive concepts. When such a culture dominates and is rewarded, creativity would seem to be reduced and new ideas are quickly killed. This prevents ideas for potentially disruptive innovations from being developed or shared between individuals or across organisational boundaries. The experience of cognitive dissonance when presented with a potentially disruptive opportunity can encourage managers to focus their attention upon prevailing explicit and implicit incentives as a strategy to reward sustaining change and to reject potentially disruptive alternatives.

### *Rejection Strategy 2*

*Ignoring positive aspects of disruptive opportunities and/or removing the negative aspects of sustaining innovation:*

Participants of the DPM interventions, from both cases, admitted (in confidence) to past occasions where they rejected potentially disruptive opportunities, in favour of sustaining innovation, by removing the positive aspects of the rejected prospect and/or removing the negative aspects of the chosen initiative. For example, in case A the management team had recently faced a resource allocation dilemma between two dissonant project options: Should they (A) increase the allocation of resources to a project that was to deliver a new high-end product in their existing core range or (B) invest resources into a project with disruptive potential in a new and totally different emerging market?

- (Option A) The senior management were insistent that they could deliver new wealth generation by educating customers to move into the high performing end of their market (where they forecasted higher revenues and higher margins). In doing so they ignored the evidence which showed that most of their customer losses were to be found at the low-end of the market and that the high-end was small, shrinking and already saturated. Much of the customer base, it would seem, had been oversupplied with performance by the traditional industry incumbents and were now happy to purchase cheaper, lower quality, substitute products from China.
- (Option B) Alternatively, evidence showed that the emerging market within the unfamiliar industry (although currently small with only potential for large growth) could provide Case A with a new high margin revenue stream. Competitive intensity within the market for the new concept was low and the current players were ignoring non-consumers and low-end customers who were in a situation of massive technology oversupply. Furthermore, the current players did not have as Case A's technologies, facilities or competencies and would struggle to deliver the potentially disruptive proposition, which was based upon a cluster of simpler technologies.

Despite the evidence the potentially disruptive opportunity was labelled by the senior management team as 'too risky' for two reasons: firstly, they felt the emerging market was 'not yet large enough' and secondly, they were 'too unfamiliar with the emerging industry'. The positive aspects of the opportunity with disruptive potential were removed and the lack of promise in manufacturing high-end products was ignored.

When presented with a potentially disruptive opportunity, prevailing mental models may encourage managers to employ strategies where they ignore the positive aspects of potentially disruptive opportunities and/or remove the negative aspects of sustaining alternatives.

*Rejection Strategy 3*

*Focusing upon historical perceptions of success:*

“We’ve always been the world leaders in ‘product X’”, said the director of R&D in case B, “we are the best in the world, no-one can make those like we do”.

The more the authors interacted with the management team in Case B, the more they were comfortable with the idea that they could generate ‘disruptions’ in unfamiliar market places. However, past success, with world-leading technologies, made many of them believe that they would not be disrupted in their current mainstream markets, despite preliminary evidence of technology over-supply in several core product categories (Christensen (1997) notes this is a key indicator of a significant vulnerability to disruptive change). Similar evidence was present in Case A.

It seemed that there existed an organisational memory, within both organisations, for the factors that have been responsible for past success and that this had become embedded in the cognitive processes and management actions. Consequently, prevailing perceptions of success were preventing the managers from visualising or embracing the potential for disruptive change in their primary technologies and customer offerings. Ideas that were incongruent with the historical paths of Cases A and B were dissonant to prevailing mental models and were deprived of resources. However, it was observed in both cases that the notion of taking current technologies and competencies to unfamiliar markets with disruptive strategies was a more appealing proposition than ‘self cannibalisation’ (Chandy and Tellis, 1998). Despite this glimpse of potential, the commercial newness involved in entering unfamiliar markets with such strategies was deemed high-risk, making sustaining innovation the preferred ‘safer’ investment option.

Psychological inertia caused by organisational memory and engrained management routines, creates a focus upon historical perceptions of success, hence potentially disruptive opportunities are rejected in favour of alternatives that sustain the status quo

*Rejection Strategy 4*

*Creating a perception of success in relation to high levels of effort:*

Evidence in the data linked to the amount of effort expended on current innovation initiatives, points to a cognitive strategy employed by managers to avoid potentially disruptive innovations that relates to the perception of desirability in relation to expended organisational effort. Participant from both cases A and B cited examples of ‘prestige innovation projects’ where significantly large amounts of effort were being invested. The targets of the high-activity, prestige projects were nearly always the improvement of highly mature products and/or next generation technological advances for familiar markets. The data analysis revealed a correlation between the amounts of reported effort that management teams had invested into their prestige projects and the perception of attractiveness of the outcome of this resource allocation.

In case A, for example, resources invested into prestige projects were targeted at improving core offerings, to retain market share and to remain competitive with insurgent Chinese rivals. It was observed that in the face of growing year-on-year competition, managers committed increasing levels of effort, yet achieved decreasing levels of benefit. Despite performance analysis, which illustrated that such project teams had reached the point of diminishing returns, senior management appeared keen to exaggerate the benefits of their high-effort projects, both in their own minds and to the rest of the business.

In both cases the more effort the management teams had invested into their prestige projects, the more they sought to exaggerate the attractiveness of the outcome of this resource allocation. Perceived attractiveness was, therefore, linked to effort and appearance and not always to measured benefits. The perception of exaggerated attractiveness provides insights into the cognitions of managers faced with the choice of allocating resources to a project delivering a sustaining or potentially disruptive innovation. The investigation shows that the experience of dissonance generated by the incongruence of an investment option and a prevailing mental model can be alleviated by deciding to fund a more perceptually desirable alternative. Hence, unjustly attractive, high-effort sustaining innovations can continue to receive resources to the detriment of potentially disruptive alternatives.

The more effort that is seen to be put into sustaining innovations the more managers can be inclined to perceive the outcome as desirable. This allows management to add consonant cognitions to such organisational behaviour and explains the maintenance of the preference for sustaining innovations in two ways: Firstly, they appear to contribute to the grand historic effort of the business, and secondly, they are more likely to immediately require large amounts of resources and aim to deliver some measurable immediate benefit than a new potentially disruptive opportunity (which will be focused upon small market niche), thus increasing the perception of contribution and comprehensiveness.

#### *Rejection Strategy 5*

##### *Holding beliefs in the face of disconfirming information:*

The final rejection strategy employed in both cases A and B was simply the dismissal, refutation and/or misinterpretation of information that was inconsistent with the beliefs of the managers. Case B, for example, had identified a potentially disruptive business opportunity in an unfamiliar market. They had managed (on this occasion) not to succumb to the previously mentioned rejection strategies and a development project had been initiated, using a 'slush fund' and 'borrowed' resources. The senior members of the project team kindly agreed to share their potentially disruptive concept with the authors, for the benefit of the current research and in return for a workshop that introduced a summary of best practice guidance and advice on the implementation of disruptive strategies, from academic literature. Concordantly, a one-day interactive workshop was designed and implemented with the senior members of the project team and an additional cross-functional support group from other areas of the business. There were 32 participants in total who took part in the 'state-of-the-art knowledge transfer activity'. On concluding the workshop, 80% of the group who were non-project members reported that the day had contributed "high benefits" to their professional development, and their understanding of disruptive innovation (20% medium-to-high benefits). All of these people reported that

they believed the concepts and frameworks that were discussed would help the project succeed. Conversely, 80% of the senior members of the project team reported their disappointment with the notion that disruptive innovations are generally more successful when initially launched with comparatively small projects for specific niche markets. In fact, the distinct majority of this group dismissed the information and sought to persuade other participants within the workshop to do the same. They reported that they believed in the potential of their concept so much, that they hoped the outcome of their development project would be able to compete directly with industry incumbents in the mainstream market. Hence, they simply chose to ignore the disconfirming information, believing instead that it was appropriate to launch a multi-million dollar, 5-10 year project, using a mass market sustaining innovation model (this may suggest that the project management team were also succumbing to rejection strategy 4).

Of the participants involved in this research that struggled, failed or refused to accept the notion of disruptive innovation, all could be considered as intelligent and diligent industrialists who wanted the best for their organisation. It appeared that there was an instinctive impulse to overvalue the beliefs that were held by the bulk of their influential peers. Thus, if an organisation's influential majority focus upon sustaining innovation, it appears to be difficult to resist this path of development. Both cases A and B lacked an active community of practice which could influence managers to embrace the notion of disruptive innovation, hence without an influential majority it came as no surprise that the concepts and frameworks were rejected by some.

The psychological discomfort experienced when new potentially disruptive ideas challenge ingrained assumptions can compel some managers to hold onto their familiar beliefs and to misinterpret the potentially disruptive opportunity, rejecting it as an unviable investment option.

### **DISRUPTIVE INNOVATION REJECTION STRATEGIES: IMPLICATIONS FOR MANAGERS**

To investigate the validity of the disruptive innovation rejection strategies, we consulted senior managers from Cases A and B and the four secondary cases C, D, E, and F in a one-day workshop; literature was also enfolded from the fields of cognitive dissonance and innovation.

When the participants began to discuss the recurrent themes from the data, there was some initial hesitancy and denial; these findings were reported to be incongruent with the images that they held of themselves or that they wanted to portray. However, the trusting, collaborative approach enabled the workshop participants to be open and honest. Consequently, they each began to 'admit' that they, or other members of their organisations, had utilised each of these strategies, both in isolation and in combination, when faced with investment options that were incongruent with their mental models regarding innovation and/or their organisations' progress. Eventually, restrictive mental models and resulting cognitive dissonance, not inflexible processes or financial mechanisms, were agreed to be the primary reason for the lack of formal resource allocation to the pursuit of disruptive innovation in each of the cases. Furthermore, despite additional rejection strategies being described, each could be deconstructed and explained by either one or a combination of the five that had emerged from the data. Thus, the existence of the five disruptive innovation rejection strategies was ratified by the wider group of industrialists.

The process of enfolded literature into the findings (as advocated by Eisenhardt, 1989) added poignancy to the emergent understanding of the rejection strategies. The industrial ratification and the enfolded of literature have enabled the development of implications for managers who wish to foster the pursuit of disruptive innovation within their organisations (Table 4)

**Table 4: Disruptive Innovation Rejection Strategies: Implications for Managers:**

Rejection strategy	Description	Implications derived in collaboration with the industrialists
<b>Rewarding incrementalism</b>	The experience of cognitive dissonance when presented with a potentially disruptive opportunity can encourage managers to focus their attention upon prevailing explicit and implicit incentives as a strategy to reward sustaining change and to reject potentially disruptive alternatives.	If executive teams intervene with the reward systems within their organisations they may be able to ensure the simultaneous pursuit of sustaining and disruptive innovations. Particular attention must be given to uncovering and changing both implicit and explicit incentives and rewards that undermine the pursuit of innovation that moves beyond the steady state.
<b>Ignoring positive aspects of disruptive opportunities</b>	Psychological inertia caused by organisational memory and engrained management routines, creates a focus upon historical perceptions of success, hence potentially disruptive opportunities are rejected in favour of alternatives that sustain the status quo	<p>The simultaneous pursuit of sustaining and disruptive innovations appears to be dependent upon an environment where managers do not feel compelled, either consciously or unconsciously, to ignore the positive aspects of potentially disruptive opportunities and/or remove the negative aspects of their sustaining alternatives.</p> <p>If management teams ensure that both they and their staff are able to see and evaluate the 'true' value and benefits of an innovation opportunity, regardless of its 'type', then they may be more likely to ensure the pursuit of disruptive innovations.</p>
<b>Focusing upon historical perceptions of success</b>	Psychological inertia caused by organisational memory and engrained management routines, creates a focus upon historical perceptions of success, hence potentially disruptive opportunities are rejected in favour of alternatives that sustain the status quo	<p>Executive management teams and the stakeholders of organisations who see the pursuit of disruptive innovations as paramount to the longevity of the business, will struggle to allocate resources to non-sustaining innovations if the workforce is tied to its history and historical perceptions of success.</p> <p>If an executive teams can ensure that their workforce is proud of its history but not tied to it, core competencies may be less likely to become 'core rigidities' (Leonard-Barton, 1992) in the face of potentially disruptive opportunities. Efforts to celebrate an organisation's competencies whilst also preparing to both learn and unlearn for the future are likely to encourage the pursuit of disruptive innovations.</p>

<p><b>Creating perception of success with high effort</b></p>	<p>The more effort that is seen to be put into sustaining innovations the more managers can be inclined to perceive the outcome as desirable.</p>	<p>Managers may become ‘blinkered’ by the ‘prestige’ that accompanies high levels of effort invested into an innovation initiative.</p> <p>If managers intervene with how success is measured in their organisation, paying particular attention to uncovering the false perceptions of success attached to high-effort projects that are actually delivering diminishing returns on investment, they may be able to avoid wasting resources on high-profile, redundant sustaining innovations.</p>
<p><b>Holding beliefs in the face of disconfirming information</b></p>	<p>The psychological discomfort experienced when new potentially disruptive ideas challenge ingrained assumptions can compel some managers to hold onto their familiar beliefs and to misinterpret the potentially disruptive opportunity, rejecting it as an unviable investment option.</p>	<p>Managers are often compelled to hold onto their familiar beliefs and to misinterpret information when deeply ingrained assumptions are challenged and psychological discomfort is experienced as a consequence; without unearthing mental models, it will be difficult to challenge them with disconfirming information.</p> <p>If executive managers uncover the deeply entrenched beliefs that undermine the pursuit of innovation that moves beyond the steady state they may be better prepared and more able when propagating the notion of disruptive innovation.</p>

### LIMITATIONS

The qualitative exploratory nature of this research has limitations. For example, the investigation does not attempt to validate or qualify the relevance of the notion of disruptive innovation; nor does it consider the managerial reactions to disruptive threats or the impact of regulations that may predicate the need for disruptive change; nor does it produce findings that are applicable to statistical analysis; it does not produce objective facts or truths; nor can we claim any generalizations to organisations outside the research group. Therefore, it does not provide all the answers to the gaps in knowledge surrounding resource allocation and disruptive innovation. However, in our investigation’s focus upon mature profit-seeking organisations and their pursuit of disruptive innovation, we have facilitated the emergence of academically robust and industrially relevant grounded understanding regarding the pursuit of disruptive innovation using a collaborative academic-industrial approach. Moreover, we have iteratively developed focus towards those elements of the resource allocation agenda that are most pertinent to the industrialists involved, all of which came from an expansive population of firms to represent the expansive nature of the research topic. The methodology employed, therefore, has generated a relevant and meaningful starting point for the continuation of qualitative investigations into industrialists’ pursuit of potentially disruptive innovations, providing insights that can be tested or probed in additional studies. The enfolding of extant literature has also enabled us reduce the potential for bias towards any particular data set.

More research is needed to qualify the origins and support structures of mental models; for example we predict that their relation to resource dependency theory would generate fruitful insights.

A Portfolio Management (PM) intervention was developed in this research due to its obvious fit with the cases' contexts and needs. It was the transfer of knowledge regarding disruptive innovation and the visual 'mapping' element of the approach that was credited with so much influence, not strictly the entire process itself. The PM approach is just one visually based tool that exposes how resources have been allocated for the organisational innovation effort; for example, another tool that is gaining industrial support and academic attention is Technology Road Mapping (Phaal et al., 2004). More research is needed to identify the exact features of the benefits of visual mapping; this should also include an investigation into other techniques and their feasibility in tackling the resource allocation barrier to disruptive innovation.

### CONCLUDING REMARKS

This article presents research that was undertaken with two primary objectives: (1) to explore the why corporations continually fail to formally allocate resources to entrepreneurial activities that seek to deliver disruptive innovations and (2) to help the industrialist involved to tackle this resource allocation barrier. The cases have provided an excellent insight into the 'resource allocation routines' problem, highlighting the five rejection strategies employed by managers that restrict resources from disruptive innovations: rewarding incrementalism, ignoring the positive aspects of disruptive innovations, focusing on historical perceptions of success creating perceptions of success with high effort and holding beliefs in the face of disconfirming information. The results of this research show that the barriers to allocating resources to disruptive innovation can be addressed, if the issue is framed in a pragmatic problem-highlighting and problem-solving context. Graphical portfolio maps can be used to illustrate an holistic view of the innovation activity and to create an understanding of the resistance to supporting potentially disruptive projects that is otherwise very difficult to achieve. These holistic graphical representations contribute to improved dialogue and communication. This generates more directed yet open discussion and prevents one person or one group from dominating the resource allocation process. Holistic tools such as the DPM can, with positive effects, increase managers' self awareness of their mental models and the impact of these internal tools when they are limited to a particular perspective. It is essential to reduce the perception of risk surrounding potentially disruptive innovation in order to remove the barriers to resources. Reducing the perception of risk can be achieved through the combination of knowledge on the notion of disruptive innovation, an holistic view of innovation activity and recognition of prevailing mental models and an understanding of how these have underpinned the decision to 'kill' potentially disruptive opportunities in the past; all of these can be used to legitimise ring-fencing resources for potentially disruptive initiatives in the future.

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