ORGANISING INNOVATION MANAGEMENT

IN EMERGING SUSTAINABLE URBAN MARKETS

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Abstract

This thesis brings together three papers to address one of the central problems in the management of innovation: how organisations manage innovations to enter, grow and succeed in emerging markets. It explores the paradoxical attributes of the firm and shows how stable and dynamic processes are mutually constitutive and occur at multiple levels.

The first paper (Chapter 3) contributes to the literature of dynamic capabilities which has recently been questioned for subsuming "rigidity" and "flexibility" within one concept. The paper employs an inductive case study approach to examine the processes by which an organisation develops capabilities to enter, grow and shape an emerging sustainable urban market. Addressing a process problem of developing novel practices into good currency, the paper develops a conceptual model within which the three sets of activities dynamically combine and interact at different phases over time. The paper argues the conceptual model individually disaggregates the paradoxical problem, and holistically underlines the two countervailing processes of capability enhancement and consolidation. In particular, the findings illustrate the institutional origins of dynamic capabilities by introducing and analysing one set of activities: capability reinforcement.

The second paper (Chapter 4) deepens the understanding of "capability reinforcement". Existing studies in institutional entrepreneurship suggest central organisations confront the paradox of "structure and agency" when they move away from embedded fields and institutionalize their innovative practices or product. The study contributes to resolving the paradoxical problem by unfolding the process of an incumbent conducting entrepreneurial actions to dominate a nascent field. Based on a longitudinal analysis of interview and media dataset, the results show central organisations implement a combination of deliberate and

emergent strategies to achieve dominance in nascent fields associated with contingent nature. Addressing a strategic problem of institutional leadership, the paper argues organisations adopt market-focused and socio-political approaches to implement such mixed strategies. The findings identify the resource-based origins of institutional entrepreneurship by introducing and examining a strategic mechanism: boundary infrastructure.

While the empirical studies are carried out independently, their combined value exceeds the sum of the individual papers. Bridging the two theoretical streams, Chapter 5 extends my contribution by developing an integrative framework which benefits from appreciating the full spectrum of multi-level consolidation in the field of innovation management.

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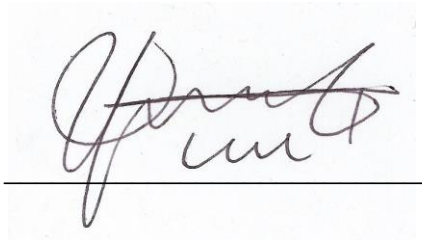

Yijiang Wu

31st July 2013, London

Date, Place

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Dedication

To my parents

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Chapter 1

INTRODUCTION

Innovation management in emerging sustainable urban markets

1.1 Research Motivation and General Questions

A major challenge facing any organisation is how to manage innovation in the time of increasing globalization and rapidly changing world. An uncertain economic climate, global competition and technological change increase market turbulence. Organisations have to keep pace with or even ahead of changing market conditions and technology innovations to remain competitive. The survival and success of firms depends on their capabilities to innovate products, processes, and perhaps most importantly their organisations. Since the Schumpeterian patterns of innovation and growth were first developed, numerous scholars have enhanced our understanding of the dynamics of innovation and competitive advantage (Cohen and Levinthal 1990, Friedland and Alford 1991, Holm 1995, Lounsbury, Ventresca et al. 2003, Maguire 2007, Wijen and Ansari 2007).

In contrast to high technology- and science-based industries (e.g. Clark and Fujimoto, 1991, Eisenhardt and Tabrizi, 1995, Von Hippel, 2009), on which most innovation research is based, the built environment industry has received less attention in studies of innovation management since firms in the industry are widely perceived as being slow to innovate (Veshosky 1998). This situation persisted until recently when ecological sustainability and rapid urbanization have created new challenges and opportunities for innovation. Greenhouse gases, particularly carbon dioxide (CO2) as by-products of industrialization, are responsible

for global Climate Change[1]. Since 2008, for the first time, more people live in and around cities than in rural areas[2]. While cities drive the engine of the global economy, they are also responsible for most energy consumption and pollution. To support their growth, high income countries are refurbishing their aging infrastructure; while, a growing population in low and medium countries means they need to handle the pressure of a growing urban population. With environment problems escalating every year and the relentless march of urbanization (especially for populous countries), greater sustainability has been at the heart of policy and standards in the built environment.

In response to these challenges, a new phenomenon in the built environment industry – 'eco-city' development (or 'ecological urban development') has emerged and attracted increasing attention. Compared to traditional urbanization, which places less focus on sustainability, eco-cities are designed as complex systems with sustainable, strongly-interlinked infrastructural, social and economic components. The development of an eco-city that is extensively supported by multi-parties and governed by particular mechanisms, is considered to be more than just a simple outline as it is a complex, dynamic, and co-evolutionary innovation process (Joss 2010). In that sense, eco-city development represents a new market category in the built environment industry. Such a changing context – people attempting a sustainable way of living – has urged a global community of organisations to come together to take action.

We contend that the emerging sustainable urban markets (or eco-city development markets) in the built environment present one of the most pressing and complex challenges for organisations in the 21st century, which is the empirical setting of this work. Such a research

1 The Associated Press (February 26, 2008). "UN says half the world's population will live in urban areas by end of 2008". International Herald Tribune.

2 Report from HM Government, 2008

setting offers a promising space for understanding how firms organise innovation because 1) the grand scale of emerging markets exhibits significant impact on organisational activities at multi-levels, and 2) the under-researched context is a volatile institutional environment associated with ambiguities and uncertainties, which exerts significant challenges for organisations. Hence, the overall research question of this thesis is:

"How do organisations manage innovation to achieve competitive advantages in emerging sustainable urban markets?"

1.2 Theoretical Approach to Research Questions

In academic studies, scholars build theories by undergoing a relatively established research process including raising problems, choosing responsive methodologies, testing propositions or hypotheses, establishing new theories or revising existing theories, and defending or acknowledging the limitation of the built-up theories. For the contemporary development of theories a large proportion of scholars will devote their time to the careful construction of new theories or defending existing ones. Even the unambiguous theory building process is regarded as a mainstream research approach; inevitably there are inconsistent assumptions, explanations or conclusions across different or even within the same literature stream (Poole and Van de Ven 1989). The contradictions coming from some research studies are viewed by some scholars as showing that poor progression towards solving the problem is being made. Other scholars make use of tensions and oppositions as theory-building strategies after closely investigating the contradictory assumptions or conclusions.

Paradox, often used interchangeably with 'contradiction', is a term indicating the simultaneous existence of two inconsistent statements widely appearing in philosophical or logical studies. A large amount of organisational phenomena in the field of innovation

management are paradoxical. Tension between purposeful individual actions and established organisational structures; rigidity and stability ensured by existing organisational proficiencies against continuously dynamic and changing emergent ones; and trade-off between individual intention and collective actions are all complex social paradoxes requiring organisational theories to explicate. For example, Quinn and Cameron (1988) categorised contradictory organisational phenomena into different types of paradoxes for their theory progression. Van de Ven and Poole (1988) analysed how social structure and individual actions interact in paradoxical ways. Ford and Backoff (1988) framed organisational behaviour in the perspective of a paradox, while Eisenhardt and Westcott (1988) explored how paradoxes in organisations help to create innovations.

This thesis explores inconsistencies, contradictions and tensions in existing theories as a theoretical approach to tackle the general research question: how do organisations manage innovation to achieve competitive advantage in emerging markets. By engaging in a paradoxical view of the firm, the thesis incorporates both faces of organisational phenomenon in emerging sustainable markets without being restricted to or overemphasizing one of them. During the emergence of new markets, both stable and dynamic processes are concurrently in existence within both organisations and markets. Incumbent organisations, although in a relatively stable state and heavily reliant on core capabilities established over many years, can be disrupted or transformed by efforts to generate renewal. Markets, although in a continuously changing state, can be guided in different directions due to the various actions or factors. Thus, the thesis focuses on addressing how organisations simultaneously manage stable and dynamic processes in the context of emerging sustainable urban markets.

Taken together, after setting the overarching theme of this dissertation, the general research question is consequently narrowed down into three paper-based themes that typically engage managers involved in the innovation process: *1) at firm level, how do organisations develop*

capabilities to enter emerging markets? (empirical study in Chapter 3), 2) at field level, how do organisations establish novel practices in emerging markets? (empirical study in Chapter 4), and 3) how can bridging theories explain firm- and field-level innovative activities in emerging fields? (theoretical discussion in Chapter 5). Embedded in the context of emerging fields, the first empirical paper addresses "a process problem in managing innovations into good currency" from a resource-based view and the second empirical paper explores "a strategic problem of institutional leadership" from an institutional-based view. In the management of innovation both of these are considered to be central problems (Van de Ven, 1986: 591). Reflecting the juxtaposition of "agency and structure" (Rao 1994), the third paper theoretically discusses the tension between resource-based and institutional perspectives and proposes a synthesis of them that can enrich organisational-based models of competitive advantage in emerging markets. The thesis concludes with the outline of each contribution to the general research question and emphasises that the essence of studying organisational phenomenon in emerging fields is not to resolve paradoxical problems but unfold the process of those changes.

1.3 Structure and Content of the Thesis

The following four chapters with self-contained contributions in each specified branch are connected to each other. The thesis starts with a literature review providing essential theoretical background through illuminating the past and current developments in the organisational capability literature which lays a theoretical foundation for the following three empirical papers to exploit and explore.

Chapter 2 *– Literature Review: Capability and Institutional-based View of Managerial Actions*

This chapter reviews two streams of literature – capability-based view and institutional-based view of organisations' managerial actions to confer competitive advantage. The review begins with an overview of organisational capabilities literature. The two various strands of theoretical approaches towards the concept of organisational capabilities, including the resource-based and evolutionary economics perspectives as well as dynamic capability view, which has been popular in recent decades, are reviewed. After reaching a hierarchical structure that interprets the conceptions of organisational capabilities, we turn our focus towards the relevant part of institutional theory since any perspective of managerial actions is embedded and monitored within its social context. We placed our emphasis on the recent development of neo-institutionalism covering the studies of institutional entrepreneurship and institutional strategies. Building upon the outcome of both reviews, we discuss the research agenda which the next three chapters of this thesis contribute to.

Chapter 3 *Unpacking Dynamic Capabilities from a Paradoxical Perspective: A Conceptual Model of Capability Development in Nascent Markets*

This paper aims to resolve some of the inherent conceptual issues within the conception of dynamic capabilities. Instead of applying the oversimplified notion to recognize the complexity and diversity of organisational behaviour, the paper develops a conceptual framework to unpack the process of capability development. Empirically the paper employs an inductive qualitative study to understand how a firm strategically developed capabilities to enter, grow and shape an emerging sustainable urban development market. Based on the analysis of 65 interviews and archival document datasets, the study uncovers that organisations undertake three sets of activities: *renewal, reuse and reinforcement*, as an outcome of the execution of dynamic capabilities, to assemble the process of capability building in emerging markets. The three sets of activities are closely correlated, but conceptually distinct. Through the analysis of interactions among the three seemingly

paradoxical activities, the paper discusses how stability and change may intertwine rather than negate or displace each other in the process of capability development.

Chapter 4 *Establishing New Practices in Nascent Fields: Incumbents' Leverage of a Boundary Infrastructure*

The study approaches a theoretical puzzle in institutional theory, the paradox of embedded agency, by dismantling the process that established organisations use to overcome existing constraints and institutional environments to successfully enter nascent fields. The paper bases the theorizing on the strengths of a qualitative study that uses interviews and data from media articles to track how an established organisation – with a global reputation in the built environment – successfully entered the emerging field of eco-city planning (ecological urban development) and achieved a dominant position over a five-year period. The study found that when establishing novel practices in a nascent field a combined approach using market-focused and socio-political means is used by organisations. The paper introduces a strategic mechanism: *boundary infrastructures* (contains a system of boundary objects) (Carlile 2002), on which established organisations rely to offer the promise of adopting both market-focused and socio-political approaches. Taken together, the study identifies the ways in which different characteristics of boundary infrastructures underpin organisations' deliberate and emergent strategies when, during the earliest phases of field emergence, there is the co-existence of heterogeneity and cooperation.

Chapter 5 *Bridging Resource-based and Institutional Perspectives in Emerging Fields*

This theoretical paper contributes by suggesting the possible integration of distinct but potentially complementary research streams. By focusing on organisations' strategic actions in emerging fields, the paper presents possibilities for closer interactions or even synergies between two literature streams: dynamic capabilities in the resource-based view (RBV) and

institutional entrepreneurship in institutional theory. Here, determining how the two bodies of literature interact in essential ways and the consideration that the phenomenon of field emergence is involved in both are the key contributions.

1.4 Research Data and Methodology

The thesis consists of two empirical papers and one theoretical paper and therefore employs a range of methodologies including qualitative case studies, quantitative statistical analysis and theory building and reasoning (Ying, 1994, Eisenhardt and Graebner, 2007). Each individual paper selects research paths appropriate for available data sources in qualitative and quantitative formats and opportunities for theory development. In particular, the two empirical papers are based an in-depth case study focusing on one firm's managerial actions complemented with appropriate statistical analysis for theory building. The case that Arup, a well-established engineering-based firm in the built environment, leveraged the world's first eco-city project to enter its unfamiliar sustainable planning territory, create new design capabilities, and institutionalise new design practices is unusual and novel (Siggelkow 2007). It was also the pressing empirical context, an emerging eco-city design field with market imperfections and institution immaturity, that makes the case unique and unparalleled (Yin 1994). Therefore, based on the analysis of mixed qualitative and quantitative datasets, the two empirical studies are able to zoom in the process of Arup's managerial effort at both firm and field levels and provide different perspectives of theory contribution.

The detailed data collection and analysis are outlined in each of following papers; the collected datasets are briefly summarised as below:

1) Semi-structured Interviews

In total, 65 semi-structured interviews with a wide range of participants involved in world's first eco-city projects, including senior and project managers in the under-researched firm from the UK and Chinese offices, local Chinese academics, practitioners and policymakers, and senior managers in the client organisation, were conducted and transcribed. For each interview the content was summarized in a mini report after being coded in NVivo 8.

2) Media Articles

The media article dataset was composed of 269 online newspaper articles related to the under-researched firm's involvement in the emerging sustainable urban market over the time span of 2005 – 2010. Both content and statistical analysis was conducted based on this database.

3) Conference Notes, Podcasts and Archival Documents

Conference notes were recorded after attending multiple industry conferences and workshops related to the topic of sustainable urban development. Annual reports and podcasts were downloaded from industrial websites. In addition the under-researched firm provided documents from its archive.

As an outline, the methodological approach and data sources of four chapters are summarized as below.

Chapter title	**Theoretical Approach**	**Data Source**	**Methods**
Chapter 2 – Literature Review: Capability and Institutional-based View of Managerial Actions	Literature review		Literature Review
Chapter 3 – Unpacking Dynamic Capabilities from a Paradoxical Perspective: A Conceptual Model of	Theory testing and building	Semi-structured interviews, conference notes, podcasts and	A single in-depth case study (NVivo 8 interview content

Capability Development in Nascent Markets		archival documents	analysis) and longitudinal analysis
Chapter 4 – Establishing New Practices in Nascent Fields: Incumbents' Leverage of A Boundary Infrastructure	Theory testing and building	Media articles, semi-structured interviews, conference notes and podcasts	A single in-depth case study (NVivo 8) and media data statistical analysis
Chapter 5 – Bridging Dynamic Capabilities and Institutional Entrepreneurship in Emerging Fields	Research Notes and Commentaries		Literature Review

Table 1.1 Research Methodologies and Data Sources

Chapter 2

LITERATURE REVIEW

Capability and institutional-based view of managerial actions

ABSTRACT

This chapter reviews two streams of literature – capability-based view and institutional-based view of organisations' managerial actions to confer competitive advantage. The review begins with an overview of organisational capabilities literature. The two various strands of theoretical approaches towards the concept of organisational capabilities, including the resource-based and evolutionary economics perspectives as well as dynamic capability view, which has been popular in recent decades, are reviewed. After reaching a hierarchical structure that interprets the conceptions of organisational capabilities, we turn our focus towards the relevant part of institutional theory since any perspective of managerial actions is embedded and monitored within its social context. We placed our emphasis on the recent development of neo-institutionalism covering the studies of institutional entrepreneurship and institutional strategies. Building upon the outcome of both reviews, we discuss the research agenda to which the next three chapters of this thesis contribute.

Keywords: resource-based view, evolutionary economics, organisational capabilities, capability hierarchy, institutional strategy

2.1 Introduction

'The Organisation of Industry' authored by George B. Richardson conceptualized the fundamental role of organisations which is "to specialize in activities for which their capabilities offer some comparative advantage" (Richardson 1972). Organisational capabilities have been referred to as critical factors explaining firm-heterogeneity, competitive advantage, and differential performance (Wernerfelt 1984, Barney 1991). Through Nelson and Winter's (1982) lens on 'What firms can do as a collective', the organisational capabilities literature covers a large body of studies and a range of constructs such as resources, capabilities (Penrose 1959, Wernerfelt 1984, Helfat and Peteraf 2003), competences and routines (Selznick 1957, Nelson and Winter 1982, Dosi, Nelson et al. 2000). Some scholars characterize it as the best practices of allocating tangible and intangible resources at the firm level; others address it as a set of routines which must have reached some threshold level of practiced activity. When taking a closer look at the literature, it suggests that the conception of organisational capability has developed from the views of several forms while also remaining vague and dispersed (Collis 1994). Therefore, it seems advisable to clarify the concept, synthesize key insights and identify controversies.

This literature review begins with a discussion of two of the fundamental strands in the theoretical approaches towards the organisational capabilities literature, which are the resource-based and evolutionary economics approaches. Although the two theoretical paths enjoy their own merits of developing the field, they are also complementary and co-evolutionary with one another. As the issues of turbulent markets and fast-moving changes have become increasingly important in recent decades, the dynamic approach towards organisation capabilities becomes the review focus. Having taken the notion of organisational capabilities from a structured hierarchy view, we turn our focus towards the relevant part of

institutional theory since any perspective of capability evolution is embedded and monitored within its social context. We review what institutional strategies have been identified which organisations employ to interact with their social context. Summing the both reviews, we raise the research agenda that understanding how organisations develop capabilities and implement field strategies to achieve competitive advantages will contribute to both literatures respectively and interactively.

2.2 Capability-based View of Managerial Actions

The pure industry analysis framework (Porter 1980) treats firms as black boxes with very limited explanation on their managerial choices. Opposite to a Porterian view, managerial studies on firms have collected a broad menu of contemporary theories of economic organisation such as transaction cost theory (Coase 1937, Williamson 1975, Williamson 1985, Williamson 1999), agency theory (Holmstrom 1982, Levinthal 1988), and behavioural theory (Cyert and March 2005). Turning towards an approach that places primary emphasis on the firm's endowment of capabilities, management studies forming the capability perspective contribute to the theory of the firm by unpacking the 'transparent box' representation of firms to examine more closely the contents inside. Insights from scholars with diversified theoretical backgrounds have offered various schools of research in the field of capabilities theory, mainly classified into the resource-based, evolutionary economics or dynamic capabilities views.

2.2.1 Resource-based Perspective

Resources are referred to 'tangible and intangible assets firms use to conceive of and implement their strategies' (Rumelt 1984, Wernerfelt 1984, Peteraf 1993, Barney 2001). A resource-based view (RBV) assumes that firms are made of bundles of resources and those

resources are heterogeneously distributed across the firms (Penrose 1959, Wernerfelt 1984, Amit and Schoemaker 1993). When a firm's key resources fulfil valuable (Conner 1991), rare (Barney 1986), inimitable (Barney 1991, Peteraf 1993), and non-substitutable (Barney 1986, Barney 1991) criteria (VRIN), the application of these bundle of valuable resources at the firms' disposal can assist the firms to achieve competitive advantages (Selznick 1957, Chandler 1977, Wernerfelt 1984, Conner 1991). The barriers of heterogeneity and immobility of valuable resources inhibit competitors from duplicating critical resources and lead to long-term differences among firms to generate above-normal returns (Barney 1991, Nelson 1993, Peteraf 1993).

A firm that possesses VRIN resources does not always gain superior performance, but capabilities are those attributes of a firm that can enable it to exploit resources in implementing strategies to achieve advantages above average (Kraaijenbrink, Spender et al. 2010). Contrasting to resources, capabilities refer to "a firm's capacity to deploy resources, usually in combination, using organisational processes, to affect a desired end" (Amit and Schoemaker 1993:35). Capabilities, developed at different levels in the management hierarchy (i.e. capability at the functional level, strategic level (Chandler 1992) and project level (Davies and Brady 2000)) within a firm, constitutes the basis of organisational capabilities when capabilities are combined at the corporation level (Dosi, Nelson et al. 2000). This distinction between resources and capabilities has been widely adopted throughout the resource-based view literature (Amit and Schoemaker 1993, Conner and Prahalad 1996, Makadok 2001). In RBV, based on the differences in availability and configuration of resources, organisational capabilities refer to a firms' capacity to acquire and deploy resources to build competitive advantages and rent differentials (Peteraf 1993, Busenitz and Barney 1997).

The study of organisational capabilities has been widely addressed from a process perspective of managing resources. As Barney et al (2011) places, the process of resource and capability development involves a need to examine the paths and sequences of their evolution. For example, one of the research streams focuses on the process of firms' path-dependent search to develop heterogeneous resources. Ahuja and Katila (2004) found that firms embark on new scientific and geographic search activities to develop performance-enhancing capabilities in response to their idiosyncratic situations such as market expansion opportunities and technology exhaustion problems. The creation of such new paths is considered as the cornerstone of resource heterogeneity (Ahuja and Katila 2004). Another research stream asserts that the process of resource acquisition and accumulation are analogous to the process of capability buying and building (Maritan and Peteraf 2011). In this regard, the capability buying and capability building mechanisms facilitate organisations to create heterogeneous resource positions that may lead to superior performance. For example, an emerging framework *resource orchestration* contributes to explaining how managers effectively structure, bundle, and leverage firm resources to realise competitive advantages organisation(Sirmon, Hitt et al. 2011). Based on the understanding of the use of resources to create competitive advantage, resource orchestration was set up as a comprehensive framework by integrating the work of resource management (Sirmon, Hitt et al. 2007) and asset orchestration (Helfat, Finkelstein et al. 2007). Collectively the notion suggests a more complex framework requiring more scholar work to examine core resource orchestration actions under different strategies, across different managerial levels and in different stages of a firm's lifecycle.

Positioned as an outgrowth of the RBV, knowledge-based view (KBV) focuses upon a single resource: knowledge; mainly on the understanding of what the knowledge is, how the knowledge typologies are defined, and how the knowledge is managed. KBV proposes

knowledge as a key resource in competitive advantage (Kogut and Zander 1992, Grant 1996, Easterby-Smith, Lyles et al. 2009), and firms are defined through the purpose of focusing on the creation and acquisition of organisational knowledge (Spender 1989). As with the notion of 'VRIN' resources, knowledge is assumed to account for the greater part of value added and is being associated with barriers to the transfer and replication of the value (Grant 1996).

Central to the KBV, an organisation's capability's potential for establishing and sustaining competitive advantage increases as the span of *knowledge* is integrated (Kogut and Zander 1992, Winter 1998). Two primary mechanisms including *direction* and *routine* point to the integration of knowledge (Grant 1996). *Direction* refers to the paths that knowledge can be integrated through at low cost using formalized procedures and standards; whereas *routines* provide a mechanism for coordination of knowledge that relies upon informal procedures to adapt to a broad range of circumstances. These two mechanisms as classified in KBV are not a unique notion and they can be found included in other schools of organisational capabilities literature, such as routine-based views rooted in evolutionary economics.

In summary, the literature of organisational capabilities rooted in RBV has evolved from emphasising the resource positions and attributes to understanding the process of *resource accumulation* and *resource orchestration* within firms' diversified context. However, concerns have been raised that the existing studies were largely conducted in the context of North American-centric. Consideration of resource and capability evolution in a more diversified international context would offer more comprehensive theoretical and empirical insights (Barney, Ketchen et al. 2011).

2.2.2 Evolutionary Economics Perspective

Evolutionary economics theory has two fundamental propositions that 1) firms have ways of doing things showing strong consistency and 2) firms have distinctive ways of doing things,

even when they aim to accomplish similar tasks (Nelson and Winter 1982). These two propositions are largely derived from the basic features of organisational routines, which act as the fundamental unit of analysis in evolutionary economics theory (Stinchcombe 1965, Tushman and Anderson 1986, Hinings, Greenwood et al. 2004). Nelson and Winter (1982) suggested that firms vary in the routines they have developed to conduct their business (idiosyncrasy of firm behaviour). They also defined organisational routines as "all regular and predictable behavioural patterns of firms. They are a persistent feature of the organism and determine its possible behaviour . . . they are heritable . . . and they are selectable . . ." (Nelson and Winter, 1982:14).

Routines, a repetitive pattern of activity, are doubtless at the heart of the classical capability conception although a capability is supposed to consist of more than just interlinked routines (Nelson and Winter 1982). A capability, in a routine-based approach, is defined as a set of routines that are at a level where they have become a practiced activity. Capabilities involve habitualised action patterns (working in a reliable manner) and the exercise of capability is typically repetitious (Dosi, Nelson et al. 2000). In this sense, routines are the building blocks of organisational capabilities (Nelson and Winter 1982, Winter 2000), although they are not the only blocks (Dosi, Nelson et al. 2000). The continuity and accumulation of capabilities is emphasised in research related to organisational capabilities that are rooted in evolutionary economics theory. Any further development of organisational capabilities is sharply constrained by past history. Moreover, studies on organisational capabilities advance the evolutionary economics theory because they infuse intentionality and conscious deliberation compared to low-level operating routines. Such distinctions between the execution of development and deployment of capabilities at a high-level (i.e. learning process) and the exercise of frequent highly repetitive activities provides a promising link between concerns about evolutionary theory and analysis in the field of strategic management.

There are obviously analogies between the resource-based and routine-based approaches towards the conceptual development of organisational capabilities. While valuable resources are recognized as being necessary, but not a sufficient condition, for firms to obtain superior performance, the resource-based approach also extends the focus from the organisational assets to its capabilities in the way that resources are allocated and utilized. On the other hand, routines can be examples of resources and capabilities. When representing the most efficient and effective way of combining and configuring resources to generate competitive advantages for firms, the definition of routines and organisational capabilities are virtually indistinguishable (Dosi, Nelson et al. 2000, Barney 2001). Not surprisingly, Helfat and Peteraf (2003) have looped 'routine-based' (Nelson and Winter 1982) and 'knowledge-based' views (Kogut and Zander 1992, Winter 1998) into various strands of organisational theory. These 'views' have a convergence in their underlying theoretical structure but slightly different approaches to the characterization of the firms attributes.

Moreover, unpacking the process of resource creation towards performance-enhancing capabilities requires the understanding of both approaches towards conceptual development of organisational capabilities. From a resource-based perspective, firms are driven to add depth and variety in their resource bases in response to idiosyncratic situations. As such firms undertake path creating search activities to create resource heterogeneity. From an evolutionary perspective, to reach an optimal level of creating path search routines is challenging (Nelson and Winter 1982). Both exploration and exploitation actions are normally employed to frequently adjust search paths in order to get close to the optimal level (March 1991). As suggest by Ahuja and Katila (2004), such process reflects the 'evolutionary nature of resource creation'.

The conceptual development of organisational capabilities did not stop even when scholars found the coherence and linkages between various approaches towards the same constructs.

As the work on the resource-based theory progressed and evolutionary theory provided foundations, both resources and capabilities are considered to be able to evolve over time in important and durable ways. The changes in organisational capabilities over time and the competitive implications of these changes are very interesting to scholars and how they happen, to which we turn next.

2.2.3 Dynamic Capabilities View (DCV)

The recent focus on the issues of volatile markets, environmental uncertainty and changes has shifted both camps of scholars' attention to an evolutionary view on organisational capabilities. An amount of related literature addressing organisations' ability to change and develop in rapidly changing markets implicates the promise of 'a new theory in the making' – dynamic capabilities view (DCV) of the firm (Teece, Pisano et al. 1997, Eisenhardt and Martin 2000, Zollo and Winter 2002, Winter 2003, Helfat, Finkelstein et al. 2007, Teece 2007). For example, from a resource-based perspective, Makadok (2001) juxtaposed resource-picking activity with capability building activity since both represent value-creation mechanisms in a dynamic market. . From an evolutionary routine-based perspective, Winter (2003) introduced the concept of higher and lower order capabilities. However, how resources are acquired or developed to build organisational capabilities and what are the routines for firms' capability development remained to be fragmentally understood in dynamic market conditions, to which the DCV, still regarded as 'a new theory in the making', can contribute. Hereby we firstly review the dynamic capability view from understanding its linkages with previously established views of organisational capabilities. We then synthesize different statements of dynamic capability definitions into a hierarchical framework of capability related attributes. Having addressed the DCV in the background of overall organisational capabilities, we examine whether DCV provides a necessary and also sufficient condition for explaining firm's superior performance. The outcome of the review

points us to another stream of literature review – institutional-based view of firms' strategy to confer competitive advantages, which we consider has the big potential for meaningful research work.

The Roots of Dynamic Capabilities View (DCV)

1) Rooted in RBV

The concept of DCV, also called dynamic resource-based theory by Helfat and Peteraf (2003), inherits insights from the RBV, with its foundation in *distinctive competences* (Selznick 1957), Richardian economics (Richardo, 1817) and Penrosian economics (Penrose 1959). Established RBV has been reviewed in situations of dynamic markets (Teece, Pisano et al. 1997, Eisenhardt and Martin 2000). Observations on environmental uncertainty and change have increasingly influenced top managers' perceptions of selecting and utilizing resources (Ambrosini, Bowman et al. 2009), which the arguably static RBV struggles to explain. In Eisenhardt and Martin's (2000) opinion, the static RBV misses the strategic role played by time that forms a fundamental dimension of a long-term competitive advantage. Hence, static RBV encounters a boundary condition in the situation of high-velocity markets (Helfat and Peteraf 2003). An emphasis on leveraging bundled resources could be adopted in the cases of moderately dynamic markets, but this would be difficult in frequently volatile markets, where 'resources are added, recombined and dropped with regularity' (Eisenhardt and Martin 2000).

To address the theoretical and practical significance of these issues, DCV was gradually developed with the aim of covering the discrepancy in RBV and matching organisational capabilities with the demands of unpredictable and changing markets. It revises the strategic management field as not only the markets but also the organisational capabilities are conceptualized as dynamic and flexible (Helfat and Peteraf, 2003: 998). The model also proposes that part of the resource base of the organisation is composed of dynamic

capabilities, but in more dynamic terms (Helfat, Finkelstein et al. 2007). Therefore, the criticism of RBV as a static and equilibrium-based model (Sirmon, Hitt et al. 2007, Teece 2007) is regarded as one of the triggers for the development of DCV, and it mutually broadens the appeal to RBV (Strebel 1996, Beer and Nohria 2000).

2) Rooted in evolutionary theory of the firm

DCV also addresses the firms' behavioural concerns grounded in the evolutionary theory of the firm (Simon 1947, Cyert and March 2005), mainly including organisational growth, routines and processes (Eisenhardt and Martin 2000), organisational learning (Fiol and Lyles 1985, March 1991, Zollo and Winter 2002) and managerial decision making (Teece 2007). Early on, Chandler, Teece, Dosi, Lazonick, Winter and Nelson has co-presented an emerging theory of dynamic firm capabilities in which core organisational capabilities are based on

> *"a hierarchy of practiced organisational routines, which define lower order organisational skills (skills required at the lower levels of the hierarchy), and how these are coordinated, and higher order decision procedures for choosing what is to be done at lower levels. The notion of a hierarchy of organisational routines is the key building block under our concept of core organisational capabilities."*

The above statement classifies organisational capabilities into operational and dynamic capabilities, and both are based on routines. Winter (2000) refers to an operational capability as performing an activity using a collection of routines to execute and coordinate the variety of tasks required to perform the activity. Incorporated with the notion of operational capability, Nelson and Winter argued dynamic capabilities are higher order routines that change routine (ordinary capabilities) as far back as 1982. Such higher order capabilities concern processes and rules through which lower types of functional capabilities or routines are integrated or changed (Winter 2003). They combine (Kogut and Zander 1992), integrate

(Grant 1996) or change (Nelson and Winter 1982, Teece, Pisano et al. 1997) lower order capabilities, practices and resources.

Definitions of Dynamic Capabilities

The notion of dynamic capabilities has been discussed in the past two decades, and there are a few key papers that have been recognized as forming the cornerstones of defining dynamic capabilities. Through various approaches towards the conceptual development, we found these definitions differentiate and overlap with each other to contribute to explaining the phenomenon.

The very first fundamental literature defining dynamic capabilities is published by Teece et al., 1997. It was "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" that comprises dynamic capabilities. Teece et al. (1997) conceptualized dynamic capabilities into three dimensions: positions, paths, and processes. Positions refer to the firm's internal and external available assets; paths represent existing established routines in the organisation evolved from the past; while processes are devoted to coordinating and integrating resources on the one hand and organisational learning and reconfiguration of resources on the other.

Based on the original definition (Teece, Pisano et al. 1997), Eisenhardt and Martin referred to dynamic capabilities as being the drivers behind creation, evolution, and recombination of resources serving as the antecedent organisational routines. They refined the original definition by Teece: "The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change." Organisational and strategic processes, for example, forming alliances or product development, were emphasised by Eisenhardt and Martin. They also indicated dynamic capabilities as not only responses to exogenous change but they also create market change.

Zollo and Winter's (2002) DCV definition distinguishes from the past in its emphasis on the notion of learning mechanisms as experience accumulation process and cognitive processes (knowledge articulation and knowledge codification). Such learning mechanisms behave as higher order search routines that facilitate the creation and modification of dynamic capabilities (Collis 1994), and are branded as 'second order' dynamic capabilities (Zollo and Winter 2002); dynamic capabilities (first order) are dedicated to the modification of operational routines (zero order) and all three form a capability hierarchy.

While also including looping learning processes as part of entrepreneurial activities in organisations, Zahra et al. (2006) highlight the entrepreneurial characters of dynamic capabilities as being those that create, define, discover, and exploit opportunities. The definition of dynamic capabilities was clearly made to be separate from substantive (or 'ordinary') capabilities of a firm: "a new routine for product development is a new substantive capability but the ability to change such capabilities is dynamic capabilities". Such a definition supports Winter's (2002, 2003) work which simply characterizes a higher-order capability as "operate to extend, modify or create ordinary (substantive) capabilities". The definition emphasises the entrepreneurial dynamism of the capability itself, not the environment.

After Teece et al. (1997) set up the foundation for DCV, Teece (2007) refined the three managerial processes (integrate, build, and reconfigure) illustrated ten years ago to become a sub-set of processes underpinning the microfoundations of dynamic capabilities. He disaggregated dynamic capabilities into three main sets of micro-processes: sensing opportunities, seizing opportunities, and reconfiguring resources. As such, Teece endeavours to provide an avenue to enter a strategic choice perspective (Child 1972) acknowledging the responsibility of managers for the actions of the firm (Ghoshal 2005). This definition is consistent with the view of Zahra et al. (2006) that enterprises with dynamic capabilities are

intensively entrepreneurial and also the term 'evolutionary fitness' in Helfat et al. (2007). The definition accommodates the view that irrespective of external environmental change, organisational changes can still be driven through endogenous entrepreneurship. While much effort was put on sub-processes fitting entrepreneurial characters, however, the relationship of DCV with 'substantive' capabilities (Zahra, Sapienza et al. 2006) or 'technical fitness' (Helfat, Finkelstein et al. 2007) were excluded from Teece's discussion.

Taken together, the above research effort related to theorising dynamic capabilities can be categorised into having two main foci: 1) antecedents to developing dynamic capabilities (i.e. entrepreneurial behaviour, sense, and seize opportunities); 2) routines, processes, and practices that enable dynamic capabilities (i.e. resource reconfiguration and organisational learning). The third important research area lies in the initiative that whether dynamic capabilities literature could help explain firms' superior performance or sustainable competitive advantage, to which we turn next.

Effects and Consequences of Using Dynamic Capabilities

One of the biggest ambitions for the development of the dynamic capabilities literature is to explain the sources of enterprise-level competitive advantage over time. In the previously published literature various models have been established to demonstrate the relationship between the firm's performance or competitive advantage and the dynamic capabilities. Among them, dynamic capabilities are conceptualized as either an independent variable where the focus is on their performance implications or as a dependent variable where the focus is on their origination and antecedents. However, Arend and Bromiley raised the controversy that there tautological links exist between possession of dynamic capabilities and their effects on the previous research outcome: "scholars have portrayed dynamic capabilities as direct drivers of competitive advantage, as preconditions, moderators, mediators and mediated or moderated drivers of firm performance or firm change, and as combinations

thereof." (Arend and Bromiley 2009) In this regard, the contemporary theoretical establishment of the 'dynamic capability' path to performance is briefly reviewed below.

Teece et al. (1997) asserted that there is a one to one correspondence between dynamic capability and competitive advantage, as well as the direct links from the firm's processes to new paths and positions. To Eisenhardt and Martin (2000), dynamic capabilities themselves were not sources of long-term competitive advantage. They stated that the long-term superior performance of the firm was built on the resource configurations by managers using, but not directly related to, the dynamic capabilities. Although exhibiting 'best practice', effective dynamic capabilities are considered necessary, but not sufficient, as conditions for a competitive advantage. Teece (2007) held a similar view as Eisenhardt et al. (2000), asserting that while best practices will not lead to competitive advantage, they are unlikely to constitute dynamic capabilities. He postulates no direct relation between dynamic capabilities and firm performance as the 'sense', 'seize', and 'reconfigure' processes lead to new positions and paths, which then affect the competitive advantage. In a highly volatile environment, Teece (2007) emphasised that the role of dynamic capabilities is necessary to sustain superior firm performance. Other critical views make the discussion even more agnostic. Zollo and Winter (2002) asserted that dynamic capabilities are only in pursuit of improved effectiveness; while Leonard-Barton (1992) refers to dynamic capabilities as an organisation's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions.

Although differential path dependence models exist widely in the field, dynamic capabilities are largely treated as an indirect link to superior firm performance through intermediate indicators such as process, paths, and positions (Teece, Pisano et al. 1997). There has been a call for new empirical studies to contest these models as there is a lack of agreement on how and to what extant competitive advantages are conferred by dynamic capabilities (Helfat and

Peteraf 2009). Helfat et al. (2007) noted that there has been a broad range of empirical work done that is relevant to dynamic capabilities, including topics related to technological innovation, mergers and acquisitions, strategic alliances, top management decision-making, and firm survival and growth etc. Clark and Fujimoto (1991) related product-development practices to intermediate performance indicators in new industrial competition (Glynn and Abzug 2002); Zahra and Nielsen showed that dynamic capabilities (e.g. integration mechanisms) vary across firms and influence variance in technology commercialization (Hensmans 2003); and Harreld et. al studied IBM's remarkable transformation to illustrate that dynamic capabilities are concrete mechanisms that help managers address the fundamental question of strategy—to develop a truly sustainable competitive advantage (Leblebici, Salancik et al. 1991). Nevertheless, scholars still claimed more empirical studies are urgently needed in the field. For example, research opportunities could lie in examining the relationship between deploying dynamic capabilities and firm's performance over time (Arend and Bromiley 2009). Teece (2007) suggests employing rigorously assembled data, facts, and anecdotes to test the existing beliefs in the field.

2.2.4 A Hierarchy View of Organisational Capabilities

The review of the previous research on organisational capabilities highlights a hierarchy of capabilities with key constructs positioned at different orders. A diagram of organisational capabilities would enable these firm competences to be assessed and understood in a balanced and structured way (Table 2.1). After all, the organisational capability literature has a broad and integrative foundation which provides a ready platform for further theoretical development. In particular, with the emergence of DCV, the research field is evolving and developing so as to reach a full understanding of organisational capabilities. As suggested by Kuhn (1970), early versions of new theoretical ideas tend to be rough around the edges and

such theories that make sense of a complex idea often develop slowly (Helfat and Peteraf 2009).

Hierarchy in Organisation-al Capabilities	Core Organisational Competences	Conceptual Interpretation	Effect in Organisational Capabilities Hierarchy	Theoretical Foundation	Practical Implications	Key Papers (Authors and Date)
Zero Order	Resources	Tangible and intangible assets in firms	Resources fulfilling VRIN criteria assist superior performance	Selznick's distinctive competences; Penrosian economics; Ricardo economics	Consistent with its conceptual definition	Selznick, 1957; Penrose, 1959; Ricardo, 1817
Zero – First Order	Routines or Processes	A repetitive pattern of activity	Basic components of organisational behaviour and repository of organisational capabilities	Evolutionary economics theory	Consistent with its conceptual definition	March and Simon, 1958; Cyert and March, 1963, Nelson and Winter, 1982; Becker, 2004
First Order	Capabilities	Ability to perform the basic function of the firm	Attributes that enable a firm to exploit its resources in implementing strategies to gain superior performance (*resource-based view*); a set of routines having reached some threshold level of practiced activity (*routine-based view*)	Resource-based theory; evolutionary economics theory	Consistent with its conceptual definition	Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984; Peteraf, 1993; Barney, 2001; Dosi, Nelson, & Winter, 2000; Nelson and Winter, 1982
Second Order	Core Capabilities, (or called operational	Ability to perform an activity using a collection of routines to execute and	Coordination and integration of resources and capabilities	Routine-based approach	Technical fitness	Chandler, 1990; Leonard-Barton, 1992; Winter, 2000; Winter,

	capabilities, substantive capabilities)	coordinating the variety of tasks required to perform the activity				2003
Third Order	Dynamic Capabilities	The capacity of an organisation to purposefully create, extend, and modify its resource base	Combine, integrate or change lower order capabilities, practices and resources	Neo Schumpeterian innovation process (Schumpeter, 1934, Teece, 2007); Kirznerian equilibrium (1973); resource-based theory; evolutionary theory; behavioural theory	Entrepreneurial / evolutionary fitness	Teece et al., 1997; Eisenhardt & Martin, 2000; Zollo & Winter, 2002; Zahra et al., 2006; Helfat, Finkelstein, & Mitchell, 2007; Teece, 2007
Fourth Order	Learning Mechanisms	Organisational learning processes supported by three learning mechanisms: passive experience accumulation, cognitive knowledge articulation and codification	Creation and evolution of dynamic capabilities; 'second order' of dynamic capabilities	Behavioural theory	Organisational learning, knowledge management	Zollo & Winter, 2002, Argot, 1999, Levitt, B., & March, J. 1988, March, J. 1991

Note: Competences sitting at each order represents as a particular part of organisational capabilities owned by a firm

Table 2.1: A Hierarchy View of Organisational Capabilities

2.3 Institutional-based View of Managerial Actions

The organisational capability literature especially DCV indicates the intention of strategy scholars to take into account of environmental conditions when understanding organisations develop their capabilities to achieve competitive advantage. At the resource level, the framework of resource orchestration (Sirmon, Hitt et al. 2011) shows that context-specific resource bundling and deployment actions affect the firm's performance. At the firm level, different paths and patterns of capability evolution can be mapped across different contexts. For instance, the institutional contexts of established and emerging markets require organisations to conduct different managerial actions to acquire resources and develop capabilities. In a sense, institutional theory also informs theories of strategic management by providing a contextual view of firm's managerial actions in achieving superior performances.

Institutional theory has generated an impressive body of theoretical and empirical work explaining a broad range of organisational phenomenon (e.g. organisational change, structure, identity etc.) (Ingram and Silverman 2002). In the last three decades, the theory was identified to have gone through four social construction periods stated as 'Foundation', 'Early years', 'Taking Stock', and 'Expanding Horizons' (Greenwood, Oliver et al. 2008). Early versions of institutional theory place emphasis on defining a few key constructs such as 'institutions', 'institutional context', 'isomorphism' and 'diffusion' and elaborate the nature and variety of institutional processes (Meyer and Rowan 1977, DiMaggio and Powell 1983, Tolbert and Zucker 1983, Scott 1987). The central assumption of the early studies suggests organisational form and practice are constrained and shaped by social rules and taken-for-granted conventions (Scott 1987). Coming from a different angle of the perspective of capabilities and resource market, institutional theorists investigates the motives of organisational behaviour (e.g. resource allocation) beyond economic optimization to social justification and social

obligation (Zukin and DiMaggio 1990). As such, institutional context including established rules, norms, and beliefs defines or enforces socially acceptable economic conduct.

The establishment of 'neo-institutionalism' (Greenwood and Hinings 1996, Scott 2001) (a convergence of old institutionalism and new institutionalism) enriches institutional theory by adding a new body of research work – institutional change (Maguire, Hardy et al. 2004, Lawrence and Suddaby 2006). Institutional change is a political process engaging the power and interests of organised actors (Seo and Creed 2002, Santos and Eisenhardt 2004). The surge of interest in the role of agency in institutional change is largely associated with the study in the field of institutional entrepreneurship (Hardy and Maguire 2007). Institutional entrepreneurship represents the activities of actors who challenge existing institutional rules, norms and beliefs, introduce new ones and ensure them become widely adopted and taken for granted by other actors in the field (Maguire, Hardy et al. 2004, Hardy and Maguire 2007).

Taking an entrepreneurial approach to the institutional theory, existing literature has analysed processes that enable the disruption of external institutional norms, rules, and standards (DiMaggio and Powell 1983, Zucker 1987, DiMaggio 1988, Scott 1995, Greenwood and Hinings 1996, Fligstein 1997). The survival of firms is not only based in their ability to adapt to the environment but also their ability to adapt the environment to their needs. Decision makers in the organisation (Child 1972) can undertake entrepreneurial actions to create innovation and affect institutional beliefs and processes. These entrepreneurial actions inferring environmental possibilities help managers to fulfil their expectations and goals in the market and distinguish themselves from their competitors.

Both passive and proactive responses to external institutional contexts have been investigated as a range of institutional strategies in the literature. For example, Oliver (1997) outlines five strategic responses to institutional pressures vary from passive conformity to proactive manipulation. The strategies of acquiescence, compromise, avoidance, defiance and

manipulation indicate progressively active resistances to given taken-for-granted institutional pressure. Manipulation, regarded as the most purposeful and opportunistic response among five strategies, focuses on the ability of organisations to strategically influence their institutional demands and expectations, similar to the notion of institutional entrepreneurship. Lawrence (1999) addresses the contours of institutional strategies that influence legislative or regulatory frameworks, affect cultural norms or values, or establish some structures or processes as taken-for-granted. In his work, the institutional processes and structures through which organisations bring about institutional pressures were examined in comparison with Oliver's work that organisational strategic responses to institutional pressures were focused.

Studies of institutional processes tended to emphasise on relatively mature organisational fields i.e. (Greenwood and Hinings 1996), however, the institutional strategies implemented by organisations in institutional fields in formative phases is far less understood (Maguire, Hardy et al. 2004). Compare to stable mature organisational fields, the dynamics of institutional change may differ in emerging fields because less established norms and patterns are available to conform and more opportunities and rewards are provided for those who succeed. We reviewed a number of institutional strategies and found such strategies to influence and shape institutional logics in emerging fields can be generally categorised into two streams: market strategies such as organisations individually promote their market solutions as new categories through emphasising on firms' competitive resources and capabilities; Political strategies such as lobbying for cooperative arrangements for building new institutions through emphasising firms' inter-organisational relationship building (Table 2.2).

Selected Papers (Authors and Date)	**Terminology in the Papers**	**Authors' Perspectives of Institutional Strategies in an Emerging Field** (quotes from the papers have been edited to deliver clear and coherent message)
Market strategy/Individual Strategy/Solution-based Strategy		
Van de Ven and Garud, 1989	Developing distinctive competences	Business should focus upon developing distinctive competences to gain competitive advantages during the emergence of new industry
Aldrich and Fiol, 1994	Gain cognitive legitimacy	One of the two dimensions of legitimacy that organisations need to raise during the early phases of an industry's life: gaining cognitive legitimacy. It is the knowledge about the new activity and what is needed to succeed in an industry.
Abrahamson, 1996	Solution-based strategy	Legitimating principles likely to be quasi-scientific, emphasizing the "soundness" of ideas
Greenwood et al., 2002	Theorisation in institutionalisation process	Commercial pressures may precipitate institutional entrepreneurship, and the basis of legitimation is primarily economic.
Peng, 2003	Market-centred strategy	A market-based strategy concentrates on competitive resources and capabilities emphasised in traditional strategy research, which are independent of the firm's networks, relationships and connections. A market-centred strategy is more often implemented at the later stage of institutional transition where rule-based, impersonal exchange with third-party enforcement prevails.
Bartley, 2007	Market-based approach	A market-based approach refers to firms' attempts to preserve their reputations and maintain market positions in the face of globalising markets
Rindova et al., 2007	Market actions	Market actions are the central mechanism through which firms compete and pursue competitive advantage; Market actions in the reputation-building process of new firms, as a vehicle of reputation accumulation
Santos and Eisenhardt, 2009	Shape organisational boundaries and construct new markets	In nascent fields, the favourite logic of action for entrepreneurs thus a logic of effectuation in which entrepreneurs try to shape the reality that they face by creating meaning and structure for other market participant. Successful entrepreneurs shape their organisational boundaries and construct new markets: claiming a market space and become its "cognitive referent" through identity-based actions, demarcating the market by specifying firm and market boundaries through alliances with established firms, and

		controlling the market by overlapping the boundaries of the firm and market over time through acquisitions that eliminate entrepreneurial rivals.
Navis and Glynn, 2010	Emphasis of firm's identities of "optimal distinctiveness"	With market growth, firms legitimate a new market category to achieve firm's distinctive identity
Political Strategy / Network-based Strategy / Collective Strategy		
Abbott, 1988	Political nature of professional activity	Jurisdictions of professions (communities of organisations) are the outcome of ongoing claims and counterclaims
Van de Ven and Garud, 1989	Promoting cooperative arrangements	Firms should be concerned with promoting cooperative arrangements for creating the industry's infrastructure as they are with gaining instrumental first-mover advantages during its emergence
Knight, 1992	Collective strategies	Theoretical conceptions of institutional emergence: - "cooperation-for-collective-benefits" refer institutions as solutions to collective action problems
Lawrence, 1999	Membership strategy	The membership strategies associated with professionalization have been undertaken principally through the formation of industry associations in which many firms and individuals work together to establish communication networks, education and accreditation processes.
Greenwood et al., 2002	Justification of social-political strategies	The diffusion of institutional entrepreneurship requires a normative justification
Seo and Creed, 2002	A political process	Institutional change is considered as a political process which reflects the power and interests of organised actors. Collective effort from entrepreneurial actors is the key to forming the new beliefs, norms and values in the emerging social structures
Peng, 2003; Peng & Heath, 1996	Network-based strategy	A network-based strategy prevails in the early phase of institutional transition. A network-based strategy emphasises on intangible assets embodied in managers' interpersonal ties and firms' inter-organisational relationships with various players.
Fligstein, 2005	Political approach	Most market institutions were the outcome of political struggles whereby one group of capitalists captured government and created rules to favour itself over political opponents

Bartley, 2007	Political construction of market institutions	A political-based approach is driven by institutional entrepreneurship around the market (not merely in it). It involves strategic negotiations of a complex set of policy arenas, and a neoliberal context.
Wijen and Ansari, 2007	Collective actions	Entrepreneurs mobilise wide range coalitions of diverse groups and to generate the collective action necessary to secure support.
Navis and Glynn, 2010	Establishing a collective identity	In the early stages of market emergence, entrepreneurial organisations claimed a shared, collective identity that helps to stabilize and fix the meaning of the category. Establishing the collective identity normalizes new market category, broaden its appeal and make it coherent in its earliest periods of emergence.

Table 2.2: Review of Institutional Strategies in Emerging Fields

2.4 Research Agenda

This chapter reviews two streams of scholar work on disparate but complementary views of the firm's managerial actions to achieve competitive advantages. The literature of capability-based view has set up an impressive theoretical field explicating the interdependencies between resources, routines, capabilities and organisational activities to confer superior performances. However, given the past research emphasising a variance approach to understand causal relationships between capability-based constructs (Kraaijenbrink, Spender et al. 2010), there is a growing scope for research that addresses a process perspective of capability-based view. Mmore empirical studies adopting process-based approaches can help unpack the black box to understand how firms develop or deploy resources, routines and capabilities in different settings. Moreover, we suggest a future research agenda based around emerging markets and fields would enrich the understanding since the past studies have been mostly conducted in the context of developed economic markets, i.e. North American countries. Probing into a different international context such as emerging economies would help examine the relative strengths and weakness of the existing theoretical development (Wright, Filatotchev et al. 2005).

The second literature stream – institutional-based view increases the research scope of managerial actions by adding an important contextual factor (Oliver 1991). Although the literature of institutional entrepreneurship have acknowledged the potential of managerial actions in shaping institutions by studying various institutional strategies, the challenges remain in explaining the process of holistic implementation of the strategies in environments where institutional framework is either emerging or transforming. Furthermore, focusing on the strategies of established ventures in emerging fields would raise concerns of falling in

unresolved embedded agency paradox (Seo and Creed 2002), which requires more clarification to be devoted. Hence, the setting of emerging fields would generate more mileage for future research in an institutional-based view of managerial actions (Peng 2002, Peng, Wang et al. 2008).

Thirdly, we believe the research work concerning the integration of both perspectives under the conditions of field emergence would help to develop a co-evolutionary perspective which may yield important insights into the processes (Volberda and Lewin, 2003). On one hand, capability-based view focuses on the economic rationality of managerial actions to confer competitive advantage. On the other hand, incorporating institutional-based view enables scholars to look at the institutional environment, which is beyond the resources and market conditions of the firm, as an important influence of firm variation. Since emerging fields are undergoing rapid market transitions as well as social and political transformation, a fine-grained explanation of managerial actions in such a setting would likely to require the research work integrating the interpretation from both perspectives.

Chapter 3

UNPACKING DYNAMIC CAPABILITIES FROM A PARADOXICAL PERSPECTIVE

A conceptual model of capability development in nascent markets

ABSTRACT

Firms rely on their capabilities to innovate their products, processes, and perhaps most importantly their organisations to address the external changing market. Prior research has focused on how firms develop dynamic capabilities in a rapidly changing environment, but the process of capability transformation in entering, growing and shaping a nascent market remains poorly understood. In addition, the notion of dynamic capabilities has been recently concerned for its inherent "capability-rigidity" paradoxical issues which become more eminent during times of market emergence. Addressing a process problem of developing novel practices into good currency, the study employs an inductive, longitudinal process study to understand how a firm strategically manages an innovative project to enter, grow and shape an emerging sustainable urban development market. The findings suggest three sets of activities: capability renewal, reuse, and reinforcement constitute a conceptual model of capability development in nascent markets. The paper explains how the conceptual model individually disaggregates the paradoxical problem, and holistically underlines the two countervailing processes of capability enhancement and consolidation over time.

Keywords: capability development, dynamic capabilities, renew, reuse, reinforcement, nascent markets

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3.1 Introduction

As global markets become increasingly integrated, new markets emerge to bring unprecedented business opportunities. Nascent markets, defined as a "business environment in an early stage of formation" (Santos and Eisenhardt, 2009:644), indicate turbulent market conditions and provide intriguing battle fields for organisations to survive or prosper. In the strategic management field, organisational capabilities are recognized as the main asset for generating and developing competitive advantages (Wernerfelt 1984, Barney 1991, Peteraf and Barney 2003). To enter nascent markets, organisations make strategic choices on how to escape from their current capability 'trap', and identify, mobilize and incorporate new capabilities into their firms (Danneels 2002). However, how organisations develop the capabilities needed to survive and succeed in nascent markets remains an issue to debate.

One prominent theory addressing capability development in response to nascent markets lies in the literature of dynamic capabilities (King and Tucci 2002). The concept explains firm's capacity to reconfigure its resources and capabilities to cope with rapidly changing conditions (Teece, Pisano et al. 1997, Eisenhardt and Martin 2000, King and Tucci 2002, Zollo and Winter 2002, Zahra, Sapienza et al. 2006, Helfat, Finkelstein et al. 2007, Teece 2007). Since both stable and dynamic processes are likely to be simultaneously visible during periods of market emergence and transitions (Quinn and Cameron 1988, Lewis 2000), scholars have questioned the compatibility of allocating two countervailing processes within one concept of dynamic capabilities (Schreyögg and Kliesch Eberl 2007). In other word, the idea of using the notion of dynamic capabilities to explain capability development in nascent markets struggles to grapple the complexity of "capability rigidity paradox" where the postulation of continuous renewal and reliable architecture of organisational capabilities co-exists (Leonard‐Barton 1992).

This paper contributes to resolving the inherent conceptual issues within the conception of dynamic capabilities. We develop a conceptual framework to unpack the process of capability development in a nascent market rather than using the oversimplified notion to recognize the complexity and diversity of organisational behaviour. Empirically we employ a process study (Van de Ven 1992, Langley 1999) to examine how Arup, a global engineering consultancy, entered, and grew in a nascent market for sustainable eco-city design solutions. The term "eco-city" refers to an "ecologically healthy city" designed with consideration of environmental impact, the wellbeing of its citizens and society, and the sustainability of the ecosystems upon which the inhabitants depend (World Eco-city Summit, 2008). We chose this intriguing research setting not only because of its obvious relevance moving towards a more sustainable global future but also because it represents an environment with a high degree of complexity and uncertainties requiring organisations to rely on dynamic capabilities for adaptation and change. Our inductive case study is built on the strengths of semi-structured interviews, site visits and non-participants observation, and numerous archival documents. Focusing on the process of Arup's capability development in an eco-city market during its formative phases, we drew inferential links from our emerging findings to generate theory about capability development (Miles and Hubermann, 1994).

We contribute by arguing that organisations undertake three mutually enabling set of activities: renewal, reuse and reinforcement, as the process of executing dynamic capabilities, to assemble the process of capability development in nascent markets. While acknowledging each set of activities makes contribution to capability development on its own right, we unravel how the interplay of the three sets of is connected to effective capability development during market emergence over time. As such, we assemble stable and dynamic processes of capability development together and contribute insights to the notion of dynamic capabilities suffered from the inherent "capability-rigidity" paradox which becomes more eminent during times of market emergence.

Our second contribution originates from the examination of Helfat and Peteraf's (2003) lifecycle model of capability development. In particular, we contribute to the literature by introducing a new set of activities called "capability reinforcement". We suggest this set of activities being essential for capability development for firms to succeed in nascent markets. By capability reinforcement, we mean the activities that help an organisation conduct proactive entrepreneurial actions to create the best context to support for their emerging capability. Rather than conforming and adapting to the external environment, reinforcement activities are required to build internal and external support to assist the firm's growth in nascent markets.

Last but not least, the paper provides practical insights and guidance to help senior managers grapple with the question of how their organisations should think strategically and systematically about how to build business in nascent markets, particularly in domains such as clean technology, low-carbon energy and integrated sustainable urban development.

3.2 Theoretical Context

Nascent markets arise when "organised actors with sufficient resources see in them an opportunity to realise interests that they value highly" (DiMaggio 1988). However, even in the face of rapidly changing environment, organisations are bound to their existing structures and actions patterns. Path-dependent organisational capabilities are influenced by a firm's past experiences which have inherent tendency to inertia (Danneels 2002). The salient concept in the debate of how firms face path-dependencies to compete in nascent markets is dynamic capabilities. As defined by Eisenhardt and Martin (2000:1107), dynamic capabilities are "organisational and strategic routines by which firms achieve new resource configurations as markets emerge". The notion of dynamic capabilities identifies organisations strategically change their capabilities in dynamic context. Organisations utilize dynamic capabilities to

decide whether to maintain and build on existing capabilities within their current market categories or revamp themselves to potentially earn higher rents in the new and risky markets. Prior studies focus on how large incumbent firms rely on dynamic capabilities to diversify and grow in the fields of new products and technologies (Teece, Pisano et al. 1997, Danneels 2002, King and Tucci 2002) and how new entrepreneurial start-ups follow paths of capability development (Helfat and Peteraf, 2003). Capability development is regarded as a 'process' associated with dynamic capabilities (Makadok 2001, Wang and Ahmed 2007). However, building and changing capabilities of a firm do not necessarily require dynamic capabilities. Other ways such as change management and "ad hoc problem solving" (Winter 2003) can drive firms to accomplish capability development. Dynamic capabilities provide the strategic approach to understanding the development of capabilities and change within firms. When capability development turns out to be an outcome of dynamic capabilities, the development trajectory has to be in line with a firm's strategic intention.

Although the literature on dynamic capabilities has led the discussion on the trajectory of capability development, a recent evaluation suggests that the concept may suffer from inherent contradictions (Schreyögg and Kliesch Eberl 2007). The debate is associated with one of the central problems in organisational theory – the capability paradox between flexibility and rigidity (Poole and Van de Ven 1989, Leonard‐Barton 1992). On one hand the dynamic feature of the concept emphasises the continuous change of organisational capabilities, on the other hand it overstretches the conception of capability which refers to a reliable architectural pattern of configuring resources to attain superior performance (Schreyögg and Kliesch Eberl 2007). Similarly, scholars have pointed out that dynamic capabilities can be structured or organic even if they involve highly experiential and fragile processes. Eisenhardt and Martins (2000:1112) state: "if there were no structures, these processes would fly out of control and exhibit no coherence". In response, Schreyogg and Kliesch-Eberl (2007) incorporated a dual-process model (recursive practice of distinctive

capabilities and capability monitoring) to both preserve the original merits of organisational capabilities and observe the necessity of capability change. Nevertheless, their conceptual paper lacks empirical evidence to validate the proposed model composed of the two countervailing processes and neglects to specify the conditions for successful implementation of the model.

Another approach providing a pathway to understand the evolution of capabilities emerges from Helfat and Peteraf's (2003) 'dynamic resource-based view' (DRBV) of the firm. Having acknowledged the concept of dynamic capabilities as an analytical tool to understand change in organisational capabilities, the approach offers the point that dynamic capabilities also refresh themselves over time. In that sense, all capabilities including both operational (core) and dynamic capabilities (Helfat and Winter, 2011) follow the development path of *capability lifecycle*. More specifically, the process of capability development needs to be examined in the paths and sequences of firms' managerial actions (Montealegre 2002, Barney, Ketchen et al. 2011). Helfat and Peteraf (2003) categorised a capability lifecycle into three stages including founding, development, and maturity. Along the lifecycle over time, practices guiding capability development are framed into six branches of selection events including:

- Retirement to retire a capability entirely
- Retrenchment to degrade the level of a capability
- Renewal to search for and develop a new capability
- Replication to apply a capability in other department/functions inside the firm
- Redeployment to apply a capability to a market for a different but closely related product or service
- Recombination to combine the original capability with other capability (Helfat and Peteraf 2003)

These activities are embedded in the wider context of managerial decisions, changes in demand, science and technology, availability of raw materials and government policy and so on. These selection events are either opportunities or threats to the capabilities of the existing organisations. Capability retirement and retrenchment refer to the threat to a firm's existing

capabilities, whereas renewal, redeployment, recombination and replication provide opportunities and guidance for new capability development. Instead of continuously changing, capabilities are considered to be part of a transformation process shaped by selection events. By including time as a crucial dimension, the lifecycle model implicates that firms need to go through a time-consuming and path dependent process to develop capabilities.

Following this approach, scholars have provided empirical evidence to explain how resources and capabilities are built up over time. For example, taking a long-term view, Miyazaki (1995) found that successful Japanese and European optoelectronic firms took closely related distinctive activities to enhance the development of their assets and competencies. However, the paper struggles to provide a process view of capability development while relying on a factor-oriented approach based on quantitative variance models. Similarly, Shamsie et al. (2009) investigated Hollywood studios over a thirty-year period and identified the influence of two complementary strategies: *renewal* and *replication* that firms use to build their capabilities. While both strategies match Helfat and Peteraf's two branches out of the total six 'R's in the lifecycle model, the paper extends the argument that by showing how renewal and replication strategies pose positive impact on the Hollywood studios' capability development rather than the organisation's dynamic capabilities. Still, because the study is embedded in the film industry with a project-based moderately dynamic environment, the paper falls in short when explaining how the two combined strategies contribute to capability development in high velocity environments (i.e. a nascent market setting) (Shamsie, Martin et al. 2009).

In summary, the literature of dynamic capabilities provides specifics of how organisations develop organisational capabilities and then how they renew capabilities to respond to rapid changing environment. However, there are relatively few empirical studies of how organisational capabilities are developed or eroded through using dynamic capabilities (Danneels, 2011). Moreover, the discussion about the paradoxical inherence suggests the conception of dynamic capabilities often fails to resolve the dilemma on deciding how and

where to draw the line between the dynamic and stability components of capabilities. On the other hand, the literature of capability lifecycle implies that the process of capability development counts. Although the capability lifecycle model highlights the importance of focusing on sequences of selection events and patterns and paths of capability development, the model struggles to explain why and how particular outcomes of capability development happen over time. Furthermore, such highly generalized overview does not provide sufficient detail about "how any one capability will evolve in any particular setting" (Helfat and Peteraf 2003). Therefore, our research zooms in a rapid changing environment (i.e. nascent market setting) on the details of how a capability is created, developed and extended, aiming to enrich the understanding of this important topic.

3.3 Methodology

3.3.1 Research Setting

A nascent eco-city market

This paper examines the process of capability development in an organisation that enters and grows in the nascent eco-city market in China. In response to the global challenges of worsening environmental problems and intensifying urbanization, eco-city or "ecological urban" developments have quickly emerged and attracted increasing attention over the past decade.

The stringent sustainable criteria embedded in this new urban development market pose a significant organisational challenge to the actors involved. Traditional efforts to plan urbanization are based on a standardized process of building or assembling infrastructure, whereas eco-city development requires sustainable considerations to be coherently integrated with the existing established practices in the stages of scheduling, budgeting, site safety and

logistics. In a social context where people are attempting to live more sustainably, the global community of organisations and stakeholders as coalesced to promote eco-city developments. Organisations moving into a this nascent market are faced with a complex, dynamic and co-evolutionary innovation process (Joss 2010).

Arup's Dongtan project and its Eco-city business

Our research is based on the investigation of innovative managerial practices carried out by Arup, a company that took on the opportunities and risks to enter the eco-city market in China. Arup, founded in 1946, is a traditional multidisciplinary global engineering consultancy with designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. The firm exerts a significant influence in the built environment given the credit from its achievements in numerous prestigious projects such as Sydney Opera House in Australia, Channel Tunnel Rail Link (France-UK), Millennium Bridge in UK and 2008 Beijing Olympics. The company has a culture of leveraging vanguard projects (Davies and Brady 2000, Brady and Davies 2004, Frederiksen and Davies 2008) to build capability in response to business opportunities.

In 2004, Chinese client Shanghai Industrial Investment Co., Ltd. (SIIC), a state-run pharmaceutical and real estate investment firm approached Arup to mastermind the first design phase of Dongtan Eco-city. Recognized as one of the world's first eco-city projects at the time, Dongtan project was initiated when the Chinese government had only recently drafted a five-year plan based on the guiding principle "sustainable development" President of China, Hu Jintao, informed the People's Congress in 2005 that *"China has to overcome the problems of environmental pollution and resource depletion"*, and added that current development trends were 'environmentally unsustainable'. Such bold initiatives from central

government, which Dongtan was associated with, were particularly influential and important in China[3].

Initiated as an experiment to create a carbon-neutral city from scratch and a prototype for the future of cities in China, the Dongtan project focused on the ambitious goals to deliver long-term ecological sustainability and economic prosperity. The new eco-city was to be located in wetlands on Chongming Island at the mouth of the Yangtze River just north of Shanghai. Its first phase, a marina village of 20,000 inhabitants, was targeted to be unveiled at the 2010 World Expo in Shanghai. The plan was that by 2020 nearly 80,000 people would inhabit the city's environmentally sustainable neighborhoods and half a million by 2050. The Dongtan project planned a city of 630 hectares, roughly three times the size of the City of London. The planning content included a transport hub and port which would accommodate fast ferries from the mainland and the new Shanghai airport, a leisure facility, an education complex, space for high-tech industry and housing. Two major goals of the project were to generate zero carbon emissions and cut average energy demands by two thirds by designing a unique city layout including energy infrastructure and buildings.

Arup formed a strategic partnership with SIIC and was commissioned to provide a full range of services for the Dongtan project, including "urban design, planning, sustainable energy management, waste management, renewable energy process implementation, economic and business planning, sustainable building design, architecture, infrastructure and planning of communities and social structures."[4] Although a range of technical solutions had been put forward to reduce energy demand and shift towards zero or low-carbon technologies for sustainable development, Arup took a more strategic and longer term view. It suggested

3 Geoff Dyer, *China to 'pioneer first sustainable city',* Financial Times Sept. 15, 2006

4 Green Progress, "Arup and SIIC sign accord to develop further sustainable cities in China," Nov. 9, 2005, http://www.greenprogress.com/green_building_article.php?id=579.

integrating these solutions to meet SIIC's targets to balance economic needs with investments that could meet more stringent environmental requirements in the future. Shaping a sustainable future in this way was a challenge because the emerging market for eco-city development was ambiguous and uncertain. Many market segments had not been properly delineated and few regulations and standards exist in the field.

3.3.2 Data Collection

We collected information about Arup's involvement in the eco-city market over a period of five years, from 2005 when Dongtan project started to 2010 after Arup completed the delivery of the design for the project. Our dataset was composed of semi-structured interviews, site-visits and nonparticipant observation and archival documents provided by Arup. The semi-structured interviews informed us of Arup's involvement in Dongtan project as well as its attempts in the transfer of capability to subsequent eco-city projects in China and elsewhere in the world. We conducted 65 interviews with senior and project managers in Arup from the UK and China offices, local Chinese academics, practitioners and policymakers, and senior managers in the client organisation. Typically we began by asking interviewees about the key decision making processes and the project influences exerted on the organisation. Most interviews ranged from half an hour to two hours. The interviews were recorded and transcribed into almost 2000 pages, supported by extensive notes. Generally we had two or three researchers present at the interviews for the purpose of minimizing single interviewer bias (Bailar, Bailey et al. 1977). We conducted the interviews with some of the interviewees more than once to track the project progress and personal judgment at different points of the timeline (Welch, Marschan-Piekkari et al. 2002). We tracked the development of the project management team to identify more key interviewees who were crucial to our data collection.

We began our analysis in parallel with initiating our data collection. We divided the process of our interview data collection into three phases. Firstly we questioned individuals from

different disciplines within Arup about their personal experiences of the project. We found the consensus about the same events and facts was high, although interviewees provided different perspectives of Arup's involvement, such as transport planning and logistic design. We matched the key facts quoted in the interviews with the information in the archival documents and documented Arup's milestone project events into a timeline flowchart (Langley 1999).

At the end of the first phase, we embarked on two field trips to Chinese client's and Arup's local office to validate and enhance our understanding of the project. These visits included non-participant observation of work process between people in the local project team as we were situated to work in the Dongtan project office (Cooper, Lewis et al. 2004). After the initial analysis of interview data and propositions, we collected more data from third parties to triangulate the initial information mainly collected from Arup. We expanded our range of interviewees to other Chinese collaborators and carried out 9 additional interviews with Chinese academics, practitioners and policymakers in May 2010. Since the data collection in the second phase was conducted after Arup's project delivery, the interviews provided us with broader insights and third-party perspectives towards the events. During this phase, we further analysed Arup's involvement at the later stage of Dongtan project, and how Arup moved into the global business of designing eco-cities. In the third phase, from July to October 2010, a member of our research team who is also a native mandarin speaker worked as a secondment in an entrepreneurial eco-city consulting firm in China. The company was founded by people who used to work as key personnel on Dongtan project with both Arup and the Chinese client. The researcher spent three months on field observation, took extensive field notes and interviewed senior managers who used to work on Dongtan project and subsequent eco-city projects. At the end of this period, we collected 65 interviews in total for our research as listed in Appendix 3.1.

3.3.3 Data Analysis

We carried out an inductive, longitudinal process study of a single case (Langley 1999) and adopted a grounded theory approach to carry out data collection and analysis work interchangeably and sequentially (Glaser and Strauss 1967). We captured all relevant aspects of Arup's activities of entering the emerging eco-city market by producing a thick description of a narrative story without being biased by any theoretical considerations (Abbott 1988). As such, rather than generalize theoretical variables, we summed up a descriptive case report on Arup's capability development from Dongtan project and the emerging global eco-city business (Glaser and Strauss 1967, Langley 1999). The report includes the information of the founding, history, values and vision of Arup and details Arup's involvement in eco-city business between 2005 and 2010. Based on Miles and Huberman's (1984:78) suggested within-site analysis and Langley's (1999:701) process mapping methods, we documented the chronology of the key events of Dongtan project into a flowchart. This enabled us to form overview consisting of antecedents, main involvement and consequences of Arup's work on Dongtan project.

Our narrative approach illuminates the longitudinal perspective of Arup's eco-city involvement based on informants' statements and our archival dataset. To achieve theoretical understanding, we coded each interview separately with the assistance of NVivo 8.0 software and drafted interview summaries. We then collated the coded informants' statements into first-order categories (Van Maanen 1995) by discerning similarities and differences. To reach saturation for every first-order category, we constantly compared statements across different interviews until no more distinct content emerged. The first-order categories provided structured and factual details covering Arup's activities of capability development in the nascent eco-city market.

In order to develop second-order categories with theoretically driven concepts, we iterated between first-order categories and the existing literature of capability development as reviewed in theoretical context section. We identified and unpacked primary theoretical constructs focusing on the triggers and mechanisms that had the power to cause observed events – Arup's actions to develop capabilities in the context of eco-city – and integrated them into second-order categories (triggers and mechanisms). For example, we identified how Arup employed various learning mechanisms to enhance their existing capabilities to deliver the novel project.

We then constructed a system of core categories by converging and interpreting the second-order categories into aggregate dimensions – third-order categories (Corley and Gioia 2011). We identified a grounded framework consisting of three theoretical constructs which abstracted Arup's activities of capability development in the nascent eco-city market.

There are two reasons for adopting a grounded theory approach based on a single case. First, while being aware of the difficulties of building theory from one in-depth case, we selected Arup's Dongtan project due to the uniqueness and novelty of the phenomenon (Siggelkow 2007). The unprecedented challenge of defining and solving the problem of how to design a zero-carbon city in China makes Arup's managerial approach an unparalleled and innovative case (Yin 1994). Adopting a grounded theory approach enabled us to stay close to the empirical details expressed in interview transcripts and the bottom up approach facilitates accurate theory building (Langley 1999). Second, the complex organisational and social interactions observed in the case make the dynamism unapparent and obscure. An inductive grounded theory approach helped to understand and clarify the complex process of capability development in this setting by drawing inferential links between data and theory. In the process of explorative analysis on our interview dataset, we converged various statements to provide coherence (Weber 1990) and to create mutually exclusive and exhaustive categories

(Miles and Huberman 1984). Our research efforts encouraged by Teece (2012:6) underlining that although studies of capability development and dynamic capabilities "can to some extent be traced by using large datasets (e.g. Adner and Helfat, 2003), they can best be analysed through in-depth qualitative research (e.g. Danneels, 2011). This empirical literature is still at an early stage and opportunities abound to dig deeper into the linkages between individual or small-group managerial actions, dynamic capabilities, and long-run firm performance. The research paradigm of dynamic capabilities is still relatively new. Accordingly, illuminating case studies …are likely to yield powerful insights".

3.4 Research Analysis and Findings

In this section we describe our main research findings based on the analysis of our interview transcripts and observation dataset. We categorise three distinctive sets of activities which contributed to Arup's capability development and facilitated temporary advantages in their each channel in the emerging eco-city market. We also uncover the mechanisms underpinning each set of activities based on the reference to our interview and archival datasets.

3.4.1 Renewal of Capabilities

The first category, renewal of capabilities is required to enter a nascent market by searching, exploring and envisioning novel solutions. It involves radical changes in operational routines, resources, internal organisational structures and decision making processes. Our analysis of interview data revealed that Arup underwent an explorative learning process to renew its urban planning capabilities for the unique sustainable city project. Two main factors prompted Arup to initiate their capability renewal process: external macro pressure and internal organisational resources.

Initiation

It was global awareness and demand for a sustainable future that fostered Arup to revamp their capabilities. Arup faced a different set of challenges in entering the eco-city market compared to those who strive to compete only in the established built environment industry. The firm confronted ambiguous market settings where there were no existing industry standards, defined design items, and benchmarks to refer to. Segments of the new market were not obvious at the outset. There were no local regulations dealing with sustainability. Arup soon discovered that a business as usual approach would not be sufficient. The firm decided that it needed an innovative process and creative design solution for the Dongtan project. As such, Arup took on the challenges of integrating multiple skills, managing a project across distributed locations and creating novel forms of financing. They had to coordinate different types of parameters of industrialization, liaise with Chinese local authorities, and collaborate with different local parties. On the other hand the Chinese client SIIC was under the pressure of delivering the world's first demonstration city in response to the political incentive towards sustainable urban development. As the director of Arup's Urban Design group explained, significant challenges were rooted in a very different social and political context in China compared to Western countries, and that was why Arup needed to adjust to adapt and respond after they decided to enter the market. While the external macro climate incentivised Arup to overcome the existing organisational inertia, the depth of Arup's expertise, sheer number of diversified technical specialists and senior managers' strategic foresights facilitated Arup to commence the process of capability renewal. A director from Global Planning group highlighted previous experiences embodied in Arup's interdisciplinary teams enabled the firm to move quickly and effectively into the new market. Also, the leadership taken by senior managers envisioning the future of sustainable cities and eco-business played a crucial role among the incentives of capability renewal.

Actions

Arup engaged in an explorative and trial-and-error process of radical innovation to address the challenges and mitigate emerging issues, as advised by a Arup's manager in local Chinese officer, including cultural planning (2005), economic modelling (2006), financial investment (2007) and mitigation of capital risks (2008) into directed solutions. The firm created a number of innovative solutions to tackle particular eco-city planning problems. But it was the integration of these partial solutions into a holistic design package that marked Arup's breakthrough innovation. Cities are complex systems that have multiple sub-systems interrelated to each other. Defining and solving the problem of planning a zero-carbon city requires unprecedented capabilities of system integration to combine multiple design components, such as transport, energy, waste, water, health, education, business and administrative functions, into an integrated urban system. In addition to the technical aspect of providing an engineering solution to urban design, Arup dealt with socio-economic factors such as cultural planning, economics, and business development in their design. Many interviewees highlighted the development of a radically new multi-disciplinary approach, known as the "integrated sustainable design" methodology was an outcome of Arup's renewed capabilities. The director of Arup Global Planning group hailed the outcome of capability renewal as below,

> *"we had a consulting division and a planning, integrated planning business …in the sense of no other consultant in the world, as far as I know, has joined all these skills together into a single business unit."*

In the process of capability renewal, we found Arup took four actions to develop its integrated sustainable design capability.

The first action was to extend and transform its existing design capabilities. A new business unit called 'Integrated Urbanism' was created to recombine internal resources into a new matrix of cross-cutting disciplines and themes. Since any disciplinary output would be the

baseline assumptions for another disciplines' input, the new business unit was created based on the principle that specialists from diversified technical backgrounds had to collaborate closely and simultaneously. The firm created a digital modelling system named "Integrated Resource Model" (IRM) to drive the new planning process. The new ICT software quantified how good a proposed design performed compared to the existing components, systems and interfaces in an easily comprehensive manner. Some other ICT tools such as SPeAR and UMF were created to enhance the process of integrated design and resource management[5].

Arup's second action to promote capability renewal was to include new contextual elements into its design practices. In contrast to other international firms entering foreign markets, Arup was aware the necessity of having a domestic presence in China to support its novel design ideas. The firm set up a Shanghai local office to incorporate local cultural considerations into their design framework. Arup acquired and recruited new people with locally relevant skills in financial planning, risk management and knowledge of governance and public policies. The establishment of a domestic base created a more hospitable working relationship with the client.

The third and fourth actions categorised as "learning from the past" and "learning by doing" highlight how where possible Arup relied upon its prior project knowledge and newly gained experiences to progress its capability renewal. For example, Arup consulted its specialists who previously worked on Dubai waterfront and Doha regeneration projects; Arup relied on its previous knowledge of establishing an education system in Weitzman Institute of Israel and proposed a similar educational supporting plan in Dongtan's economic model; and Arup also applied part of the integrated waste system in its Majorca project into Dongtan integrated

5 Sustainable Project Appraisal Route (SPeAR) was designed to assist setting sustainability objectives, tracking sustainability of projects along its lifecycle and assessing alternatives where a decision needs to be supported. Urban Management Framework (UMF) was particularly initiated to make sure the operational roles to deliver integrated urbanism design are considered at the early planning stage.

design. In this regard, people with relevant knowledge and experiences were assigned to work on the Dongtan project. They were able to compare what was needed to design Dongtan with previous project experiences and make the necessary improvements and adjustments.

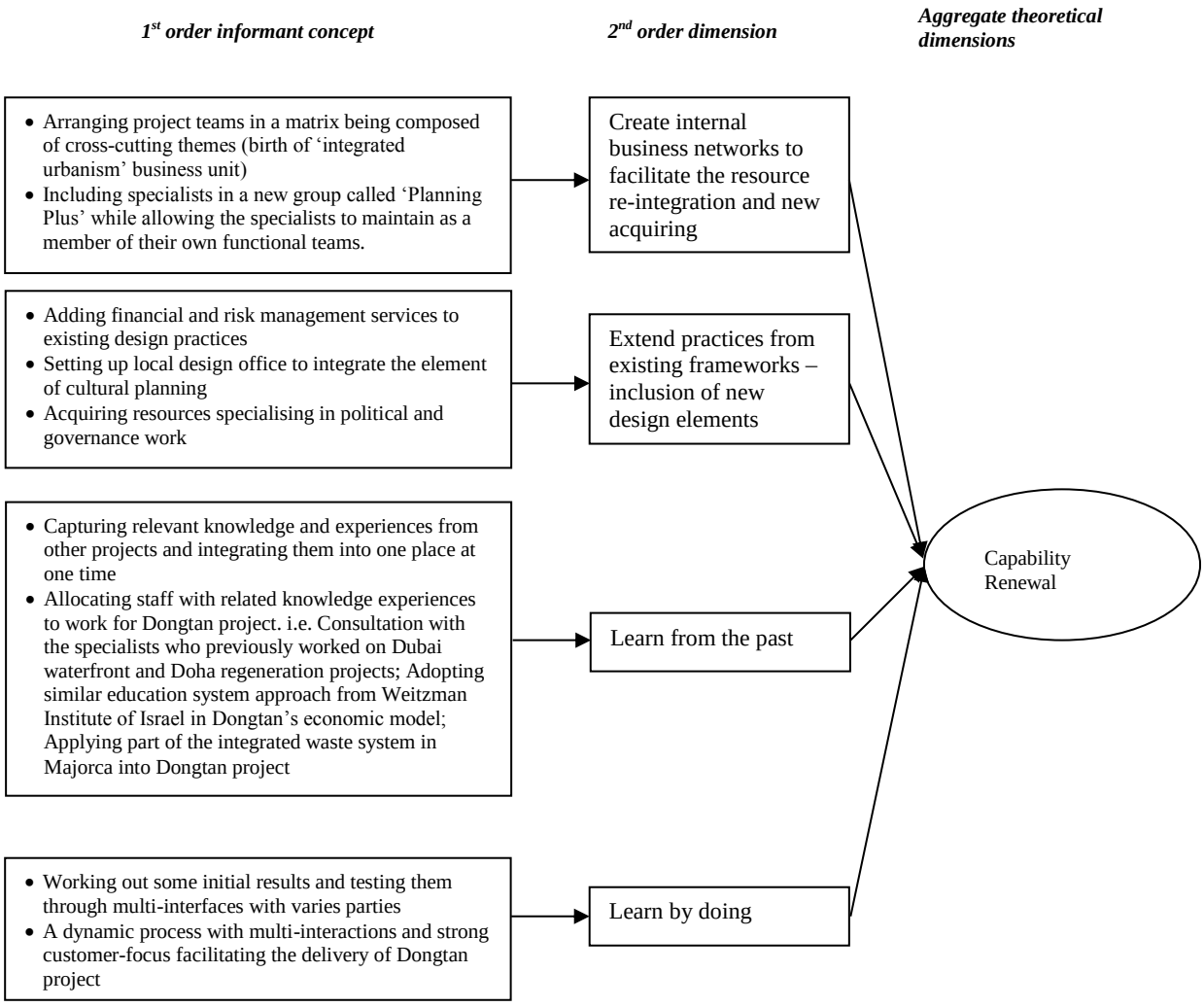

Figure 3.1 – Inductive Data Analysis for Generative Elements: Capability Renewal

In summary, our findings confirm that firms entering highly uncertain nascent markets can no longer rely on enriching their existing capabilities and products (Ahuja and Morris Lampert 2001). Instead, they have to develop and hone new capabilities (Shamsie, Martin et al. 2009). Arup underwent a process of enriching existing capabilities by blending new resources with the existing ones to create novel capabilities. The four identified actions underpinned the process of Arup's capability renewal in eco-city planning. The capability renewal process resulted in the radically new multi-disciplinary integrated sustainable design and more

efficient managerial decision-making supported by a new matrix organisation system and ICT tools.

3.4.2 Reuse of Capabilities

In the renewal phase, Arup generated a set of novel solutions and tools to plan an eco-city socially, environmentally and economically sustainable. Such knowledge and experiences gained from Dongtan project formed the cornerstone of Arup's new design and resource management capabilities. Nevertheless, it was not possible for the new knowledge and skills to reach the level of reliability after only one project. In order to further develop and stabilize its renewed operational capabilities, Arup redeployed or replicated the new knowledge and skills through a variety of channels including practicing them in different project settings and establishing long-term relationship with key clients (Figure 3.2).

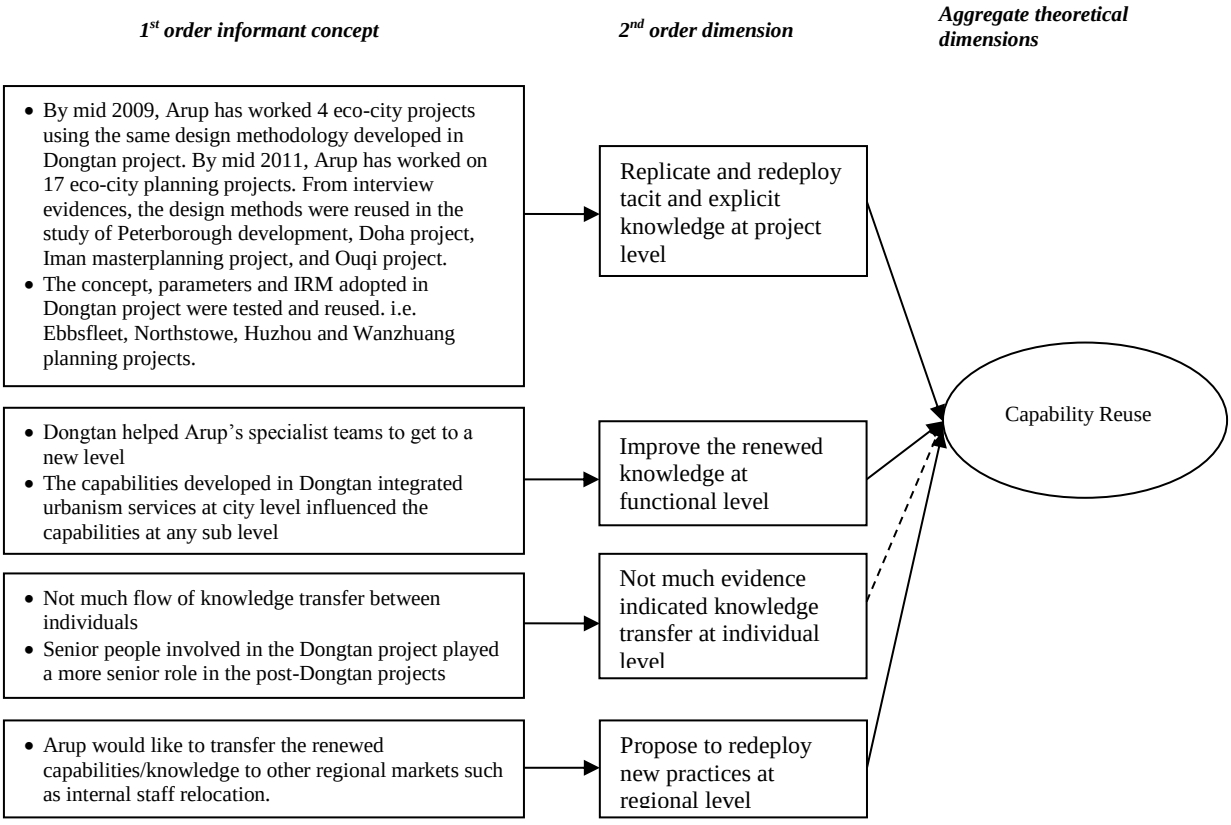

Figure 3.2 – Inductive Data Analysis for Generative Elements: Capability Reuse

We define the activities of building upon and refining new capabilities as *Capability Reuse* (Helfat and Peteraf 2003). Reuse of capabilities entails redeploying the newly established capabilities to build and grow a business in the new technology or market base. This phase of iteration, fine-tuning and exploitation occurs when new capabilities are employed on subsequent projects in different parts of the world. For firms like Arup that mainly conduct their business through projects, the activities of capability reuse are largely exercised at project level. At the later stage of Dongtan project, Arup was awarded contracts for a number of eco-city projects as well as sustainability related projects elsewhere in the world due to the successful recognition of its novel solutions. A long-term relationship was developed with SIIC for the purpose of transferring traditional client–consultant relationship into a major framework aiming to deliver sustainable development across the whole China. By mid-2009, Arup had worked on 4 Eco-city projects adopting the same design framework as Dongtan project while in 2011 Arup had delivered 17 eco-city projects.

One of the subsequent projects to involve Arup's capability redeployment was the delivery of a 7.4 million ft² integrated masterplan surrounding the UK's Ebbsfleet international railway station on behalf of Land Securities. Ebbsfleet project was the first project that Arup charged its client for the cost of using IRM. The total cost Arup charged by using IRM digital tool was smaller than the accumulated small numbers bided by other competitors. An Arup director of Urban Design London explicitly noticed the improvement in the efficiency of methodology in the Ebbsfleet project,

> *"Two or three times of iterations of the whole process (integrated design methodology supported by IRM tool) can get the project humming. Dongtan iterated three times and Ebbsfleet iterated twice. This iteration process in the masterplanning stage is able to give the following design a much more advanced cutting edge … You can sell these targets to clients for the purpose of asking for financial support."*

Arup's capability to manage complex sustainable design work was also transferred to the UK's Northstowe project. It was the first time that the integrated design method was tested since its creation. The testament was further carried out in another two Chinese masterplanning projects as well as the Jeddah central area development project.

In addition to project-to-project process, Arup's 'reuse' strategy to diffuse and improve new knowledge and experiences was also conducted at functional, organisational and regional levels. At functional level, the iterative redeployment of integrated design services at urban level gave a significant lift to Arup's design services. As a senior environmental consultant explained, "the waste strategy for Huzhou development will be a lot better because they've learned an awful lot from the waste strategy in Dongtan. During the next phase of work Arup will be updating Wanzhuang's waste strategy and making it much better". At organisational level, the restructuring involved in moving into the eco-city business created some resistance and turbulence within Arup. The Integrated Urbanism business unit established for Dongtan project in 2005 has been transformed and merged into one of the four mainstream businesses named Economics and Planning group in 2010. At the regional level, experienced people in the eco-city business were relocated and promoted to lead other regional eco-business. According to a director in Integrated Urbanism team in Planning Plus Group,

> *"you know, the transfer isn't just Europe, it isn't just China, it's everywhere – America is all over it, Australia are very keen, we've just done a project for an Abu Dhabi client in Malaysia who didn't know what they wanted, but once they, you know, go through it, recognized the benefit to them."*

During the rolling process of capability reuse, Arup found that the new design practices could support any of its eco-related business. The director of Global Planning group stressed that,

> *"(Arup didn't provide) eco-city service but just integrated urbanism services. Because the objectives don't have to be at eco-city level they could be any level. Eco-city is a sort of level of objective really…It's absolutely the same methodology."*

In summary, there was a risk that the capabilities generated by the Dongtan project would be lost when the project finished, team dissolved and members of the project moved on to other business tasks. Both explicit and tacit knowledge and experiences were accordingly redeployed when business provided opportunities. Since the firstly created knowledge and skills were embedded in the particular context of Dongtan project, Arup contextualized the new practices whenever reapplied and redeployed them. The capability reuse strategy requested Arup to reuse the insights, approaches and tools that included process of identification, selection and transfer of useful tools and methods across multiple levels.

3.4.3 Reinforcement of Capabilities

Members of the Dongtan project had to overcome established industry routines and standards by encouraging members of its own organisation and clients to embrace a new way of thinking. We found Arup conducted activities of reinforcing renewed capabilities to overcome internal organisational inertia and external market resistance. Below we analyse how Arup provided internal support for the development of new capabilities and externally built institutional momentum to shape the nascent market.

Internal reinforcement

Organisations embarking on a path of renewal are often vulnerable and exposed when first challenging "incumbent inertia" associated with established organisational routines and standards, internal political dynamics and stable exchange relations with other organisations (Gilbert 2005). Having achieved initial success in creating new practices and renewing capabilities from the Dongtan project, Arup confronted a tension between those people committed to performing existing routines and those promoting the new design framework. A director of Global Planning group, addressed the concern that new practices required the alignment of otherwise opposed interests, *"because they'd all have their own targets and objectives and they'd be worrying about, well you've changed the scope of work, you know,*

I've got to re-negotiate my time and stuff." Rather seek a compromise, key senior managers in Arup reinstated the belief in the capability development trajectory and employed three mechanisms to maintain the momentum behind the new approach.

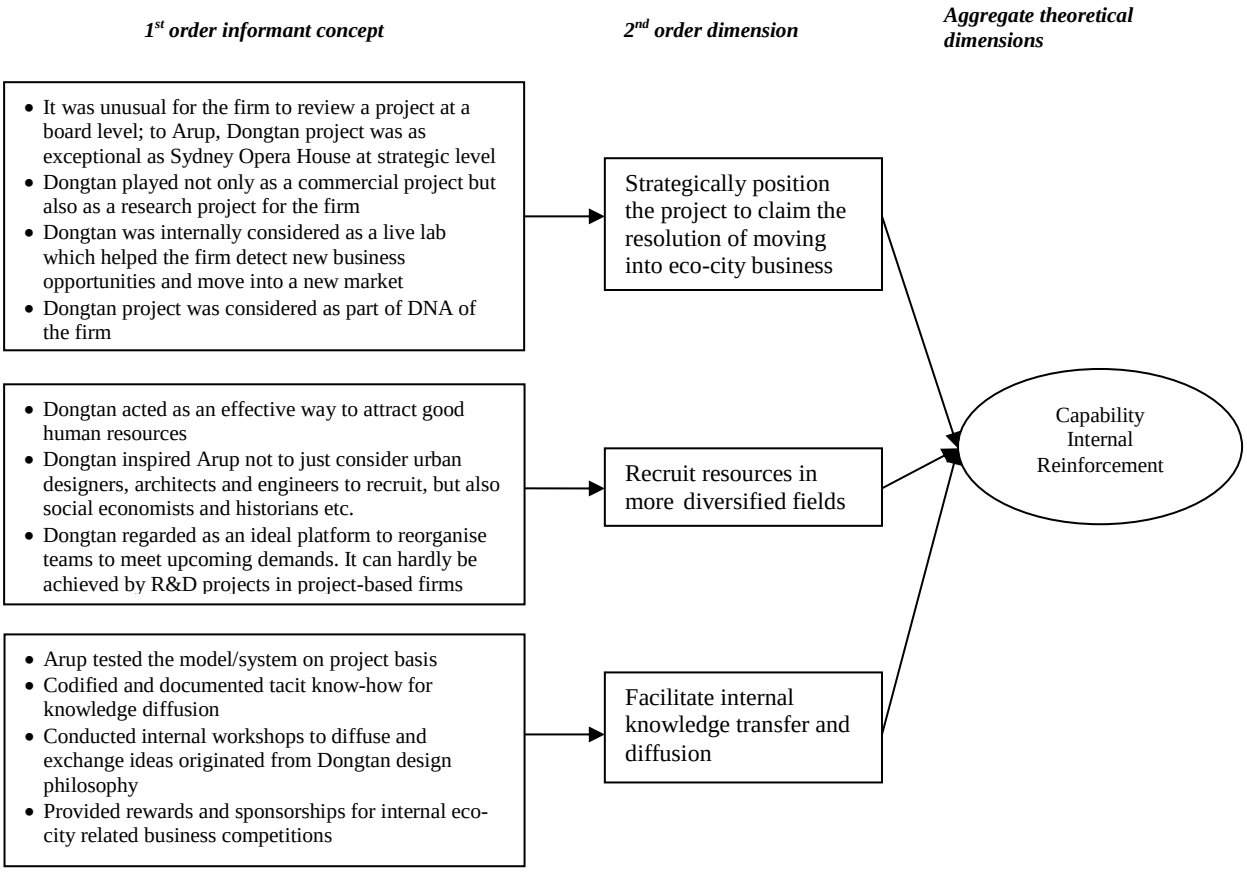

Figure 3.3 – Inductive Data Analysis for Generative Elements: Capability Internal Reinforcement

The first mechanism was to ensure that the new approach to urban design conformed to the firm's strategy at senior management level. Dongtan project was held up as a vanguard project (Brady and Davies 2004) which would show the way forward for Arup's approach to urban design. It would also impact across all aspects of the firm's mainstream business. As suggested by a senior urban designer within Arup, *"it was widely considered that Dongtan is the next Sydney Opera house for Arup in terms of importance"*. From the perspective of internal consistency, it was important that Arup rearranged its internal structure to manage the transition from traditional engineering-based services to the provision of sustainability consulting services. In 2005, Arup created Integrated Urbanism business unit which grew

from 5 individuals to over 150 specialists working in multi-disciplinary teams. By the end of 2011, the new unit has become part of Economics and Planning group which delivers one of Arup's four mainstream business services.

The second mechanism that Arup employed was promoting and recruiting staff to strengthen a new and broader capability base. Internally Arup reallocated and promoted experienced people who were involved in the capability renewal and reuse phases and encouraged them to lead subsequent eco-city related projects. The attraction of working on iconic eco-city projects helped Arup recruit talented people from experienced specialists to graduates from leading universities. Arup was no longer confined to selecting staff with a traditional engineering background but in need of people with expertise in economics, history, and culture to bring in the breadth of knowledge required to work on integrated sustainable urban solutions. As suggested by the director of Integrated Urbanism team, *"people come to Arup because of the projects we can offer them, and because of the underlying philosophy, and this whole push towards climate change".*

Thirdly Arup focused on diffusion and transfer of the new knowledge and skills to promote the idea and philosophy of integrated urbanism. Internally, Arup encouraged experienced staff to organise workshops, presentations and seminars to showcase the knowledge of integrated sustainable urbanism across the firm's different business units and geographical locations. An important aspect of this internal marketing was to codify the tacit knowledge already gained and make it comprehensible and easily accessible to employees within the firm. Social networks were also established on Arup's intranet to support the internal flow of knowledge.

In summary, our data demonstrate that the combination of members, tools, tasks and social networks provided the mechanisms enabling Arup to overcome internal scepticism and resistance to the new practices and strengthen the firm's eco-related businesses.

External reinforcement

Externally, Arup faced the challenge of establishing legitimacy to support the new practices and its entry into uncertain markets. Arup conducted activities of external reinforcement to help prepare the market, including clients, customer, governments and other users, for its new product and service offerings. We found two enabling conditions for Arup to externally reinforce their distinguished capability gained from the involvement in Dongtan project (Figure 3.4).

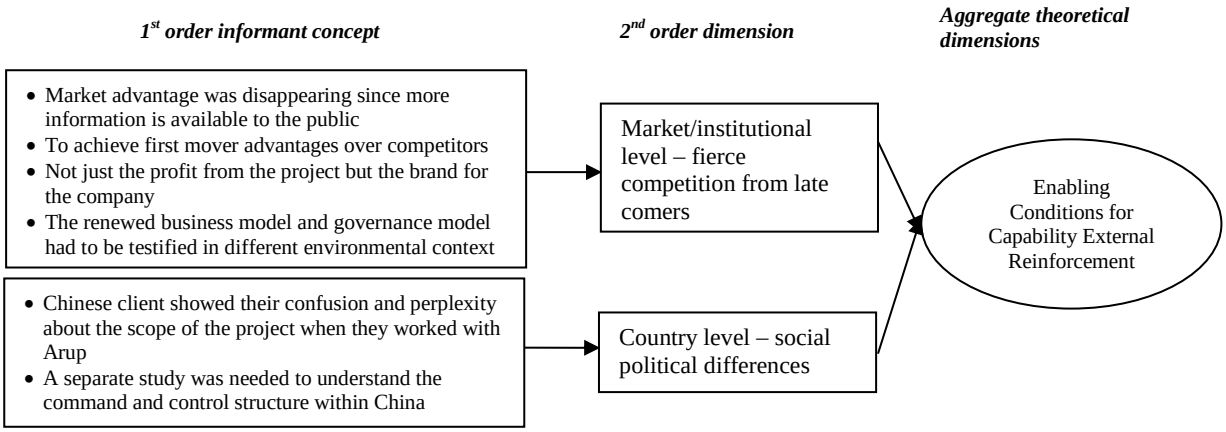

Figure 3.4 – Enabling Conditions for Capability External Reinforcement

First Arup was keen on capitalizing and sustaining the company's first mover advantage in the emerging eco-city market (Lieberman and Montgomery 1988). Since the eco-city market was in its formative phases, first-movers like Arup were exposed to a high degree of uncertainty and ambiguity. Unless Arup resolve uncertainties and shape industry standards in their favor, late-movers can gain an edge through the resolution of market or technology uncertainties (Wernerfelt and Karnani 1987). Thus, Arup had to not only overcome the sluggish or aggressive responses from established market incumbents, but also legitimize the innovative design package as dominant design in an emerging market. Second, cultural differences between eastern and western world motivated Arup to engage in social constructions of their renewed capabilities. Many interviewees identified the pressures of working in a different social and political environment. Nevertheless, the novel market

solutions cannot fully cope with the scope of settling social and political differences in the aspect of value understanding.

In response, Arup engaged in two sets of activities to defend, control and promote their novel approach in the market: (1) media and market promotion of Arup's novel practices, and (2) social and political engagement in the construction of the nascent market (Figure 3.5).

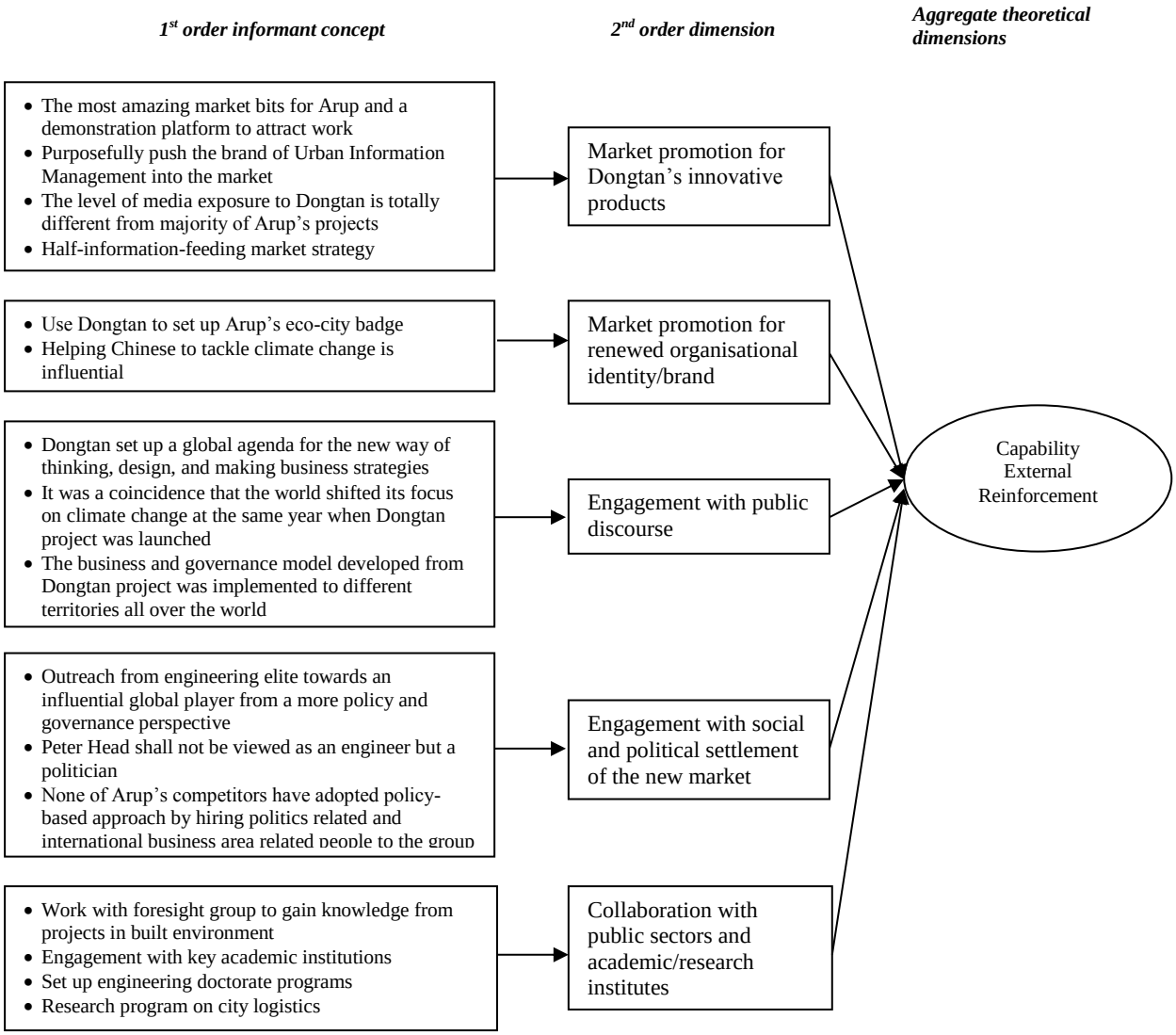

Figure 3.5 – Inductive Data Analysis for Generative Elements: Capability External Reinforcement

Arup constructed arguments to support and promote the market value of its novel eco-city solutions. The organisation was actively involved in communication with public media by feeding part of the novel design practices freely. One Energy director in the group said, *"you*

feed the market half of the information, and what happens is other people come to you talking … and what you're finding is they're bringing further bits to the jigsaw which they don't realise they've got because they're in isolation, and you're gathering more. So that come two year's time half that information has got on to the market and you've built another half…you're deliberately open to ideas … so the moment everybody else thinks they, ah I've grasped it, you're actually working on something completely different". The organisation created positive image by frequently presenting its eco-city conceptions to the wider public. It arranged conferences that attracted potential clients and produced brochures and newsletters for widespread dissemination. Meanwhile, Arup engaged in a series of activities to transform its organisational identity from an engineering-based firm to a broader consulting service provider. The company branded the new eco-city practices as a holistic consulting package that would be essential for the delivery of any eco-city development. *"I think this is a big leap internally to go from an engineering type, architect type physical approach to a more cultural and social approach in urban design".* Consequently, the whole consulting package provided a real platform to showcase its renewed capacities.

Arup was also heavily involved in the social and political construction of the nascent market as a way of their capability reinforcement. Eco-city development is a longitudinal rather than a one-off process (Joss 2010). There are social and political conflicts associated with developing industrial standards and regulations. One mechanism the organisation employed was positioning Dongtan project at the very front of the eco-city market demonstration to set up a global agenda of "ecological age". One of Arup's directors produced an 80 page report published by Institute of Civil Engineers to provide a new way of thinking, design and business strategy making (Head 2009). The other mechanism saw Arup extending its role towards to an influential player from policy and governance perspective. For example, in June 2006, Arup's sphere of influence in the emerging sustainable city market was enhanced through the UK Guardian newspaper's report on Arup's key involvement with former London

mayor, Ken Livingston's sustainable development commission, in the London Thames Gateway plan. The report demonstrated that Arup's external reinforcement activities had been effective in pioneering the nascent market beyond China. In October 2006, the report on London mayor's visit to Shanghai Dongtan area further magnified the hype of the project and promoted Arup's unique vision, novel philosophy, methodology and fresh capabilities as the beacon to achieve a low carbon future

3.5 Discussion

3.5.1 A Conceptual Model of Capability Development in Nascent Markets

In our exploratory analysis, we uncover three distinctive sets of activities as the basis for Arup's capability development to succeed in nascent sustainable urban design market. While highlighting that Arup benefitted from each set of activities to create a series of temporary advantages edging over its market competitors, we also found Arup opted for a holistic combination of three 'R' activities to fulfil their strategy of succeeding in nascent markets. Hereby we discuss the mutual interactions among the three sets of activities that Arup employed as a holistic approach and propose a conceptual model of capability development combining the three interdependent 'R' components (Figure 3.6).

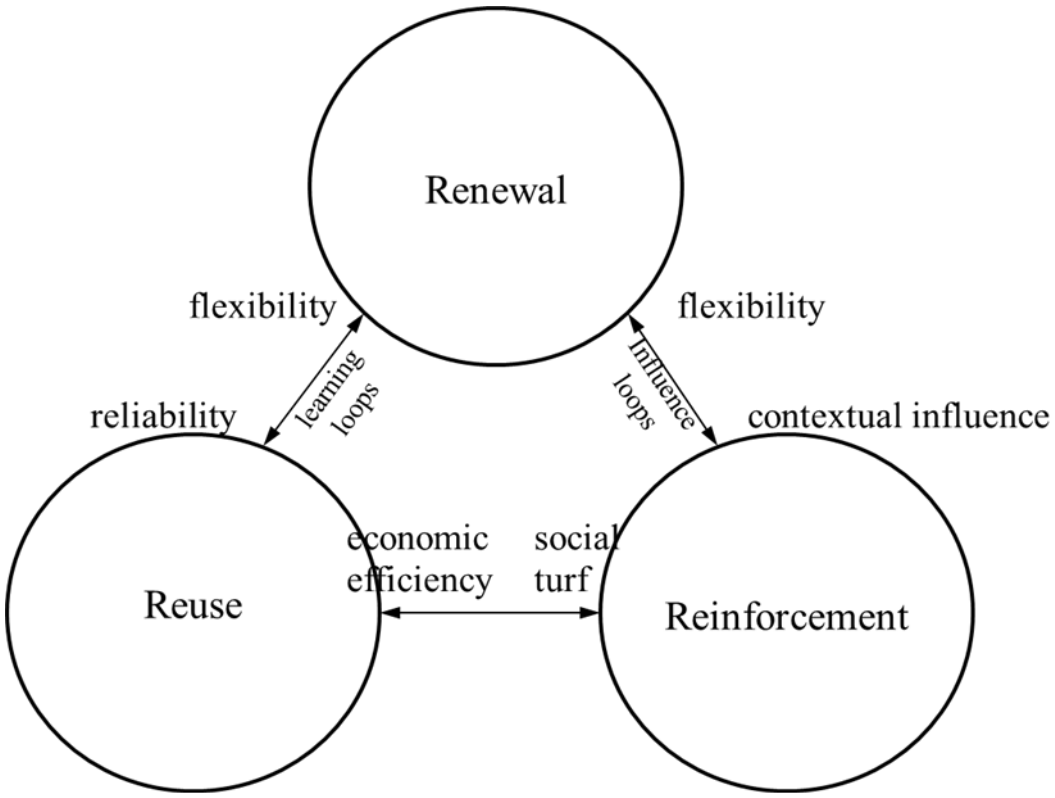

Figure 3.6 – Conceptual Model of Capability Development in Nascent Markets

Combining renewal and reuse activities

In the analysis of capability renewal, Arup employed its dynamic capabilities to sense market opportunities (key trigger: external market demands) and seize opportunities (key trigger: internal organisational proficiency) to move their mainstream business into the new market base. Through the recombination of existing resources and capabilities and organisational learning, Arup created fresh capabilities in new trajectories as an outcome of executing dynamic capabilities. In this regard, the 'dynamic' dimension of organisational capabilities is emphasised because the renewal activities start a new lifecycle of capability development process. Similar to the 'learning organisations' (Weick 1995), capability renewal emphasises the 'chronically unfrozen' aspect of organisational capabilities and highlight the nature of flexibility and change.

When capability renewal resulted in a strong performance and attracted more business opportunities, Arup needed to further develop the fresh capabilities into reliable patterns and

make it more operational. Capabilities can only provide organisations cutting edge over other competitors when they are based on ‘a collection of routines, skills, and complementary assets that are difficult to imitate’ (Teece, Pisano et al. 1997). Analogous to the ways in which individuals perform skills to achieve personal objectives, Arup repeatedly exercised their renewed capabilities to hone and improve the performance of novel integrated sustainable design practices.

Hence, the linkage pointing from capability renewal to capability reuse indicates a firm’s initiative and continuous effort in benefitting the fresh capabilities with economic efficiency (Figure 3.6). It shifts the emphasis of capability development process from ‘dynamics’ towards ‘rigidity’ dimensions. On the other hand, the linkage pointing from capability reuse to renewal represents organisations’ initiative to consequently renew the fresh capabilities again guided by the learning from the activities of capability reuse. As a whole, the double arrowed linkage represents the transition process of shifting capability development in between full flexible and stabilized capability patterns with high economic efficiency and forms as ‘learning loops’ for capability development. Instead of negating and displacing one another in a seemingly paradoxical way, the ‘renewal’ and ‘reuse’ activities mutually reinforce each other. As such, the two components individually disaggregate the “capability-rigidity” paradox (Leonard‐Barton 1992) from an efficiency perspective and collectively attribute to the two countervailing processes within one model.

Combining renewal and reinforcement activities

The interrelations between Arup’s renewal and reinforcement activities can be regarded as a reflection of the dynamics between organisational capability evolution and the firm’s internal and external environment. While dynamic capabilities add contingency factors to capability development via market conditions (Eisenhardt and Martin 2000), the existing studies often focus on how organisations adapt and conform to external changing conditions. In our case, the actions of capability reinforcement suggest firms competing in nascent markets need to

shape internal and external social conditions rather than the other way around. Thus, the transition from renewal to reinforcement phase indicates Arup's instigation to gain internal legitimacy for renewed design capabilities and influence external market belief systems in urban design. As a consequence, feedbacks from the activities of capability reinforcement influenced Arup's later strategic decisions on whether to enhance or retire the renewed capabilities, as represented by the reversed arrow pointing from capability reinforcement to renewal in Figure 3.6.

Therefore, the linkage between capability renewal and reinforcement represents the reciprocal processes of changing and stabilizing capabilities with a contingent pattern of market conditions and forms as 'influence loops' affecting the trajectory of capability development from a contextual view. Similar to the interdependences and complementarities between renewal and reuse, the linkage between renewal and reinforcement disaggregates the "capability-rigidity" paradox from a market perspective (Leonard‐Barton 1992) and incorporates the two countervailing processes within our conceptual model.

Combining reuse and reinforcement activities

In contrast to the previous two linkages which highlight 'flexibility' and 'rigidity' temporarily and iteratively in the process, the reuse and reinforcement components both reflect Arup's incentive to stabilise the outcome of capability renewal. On one hand, reuse and reinforcement activities place their emphasis on different aspects of capability development; one the other hand, the two components interchangeably and mutually interact with each other along the whole process of Arup's building capabilities in integrated sustainable design. Reuse activities aim to benefit Arup from large-scale exercise and expand or change the new-born capabilities. The practices of capability reinforcement echoes Cyert and March's (1963:1) claimed necessity of supplementing 'the study of market factors with an explanation of the internal operation of the firm'. The two sets of activities elaborate capability renewal in respective aspects with capability reuse highlighting economic efficiency and capability

reinforcement stressing social turf and legitimacy for the novel design practices. Moreover, sometimes the boundary of two sets of activities became blurred and the actions overlapped with each other to contribute to the capability development. For example, Guardian, the top newspaper in UK, reported that former London Mayor, Ken Livingstone intended to plan Thames gateway eco-development based on Dongtan's model. The public news indicated Arup undertook one action for the purpose of both capability reuse and reinforcement.

3.5.2 The Longitudinal Three 'R' Model of Capability Development

The previous discussion suggests a holistic combination of three activity sets forms a conceptual model for organisations to develop capabilities to adapt and even capitalise on a rapid changing environment – nascent markets. The conceptual model provides factor-oriented implications concerning the impact of a disparate set of activities on capability development where dynamic and stable processes seem to be simultaneously visible during market emergence. The case of Arup's capability building in the emerging sustainable urban market also reveals the development of new design capabilities was a gradual and expansive process.

To understand how the timing and sequencing of these activities help grapple with the complexities of capability development process, we drew on our collected dataset and synthesized the key milestone events in related to Arup's involvement in the emerging eco-city market over a period of five years (2005-2010) (See Appendix 3.2). We then categorised the events into the three sets of 'R' activities indicating how Arup developed their integrated sustainable design capabilities during the period of the Dongtan project (2005-2009). We also illustrated the events in 2010 after Arup finished the Dongtan project to help understand how Arup's renewed capabilities tended to evolve at a post-Dongtan stage. Based on the record of Arup's three 'R' events from 2005 to 2010 (Table 3.2 in Appendix 3.2), the following table outlines the number of events for each category of capability development activities.

	No. of events of Capability Renewal	No. of events of Capability Reuse	No. of events of Capability Reinforcement
2005	5	1	0
2006	4	1	5
2007	5	4	7
2008	6	10	15
2009	1	3	10
2010	1	4	10

Table 3.1 Event Frequencies for Each Activity Category of Capability Development

The evidence presented in Table 3.1 has important implications. Activities that support the development of capabilities to reinforce the philosophy of new integrated design approach in the emerging sustainable urban market seem to contribute from the early phase of the capability development process. As illustrated in Table 3.1, the actions of capability reinforcement started from 2006 when Arup was still in the early phase of capability renewal such as assembling new teams, establishing new business unit, and forming the initial ideas of adopting a novel integrated design approach. More specifically, as early as August 2006, Arup started to reinforce the influence of its novel capabilities by attracting attention from UK mainstream media sources such as The Times, The Independent, Financial Times and Guardian. In January 2007, Guardian published a report based on an interview with Arup detailing how Arup master minded every aspect of the Dongtan project covering the considerations of local history, geography, environment, technology and investment strategies. Following the early start of capability external reinforcement Arup continued their effort in helping to prepare and shape the emerging market, including a wide range of clients, customer, governments and other users, for its new sustainable design offerings. In terms of the internal reinforcement of capabilities, Arup also started at an early phase through positioning the Dongtan project at a strategic level within the firm. A number of interviewees suggested that the appointment of Arup's new planning director Peter Head in November

2005 should be regarded as a milestone of gaining the internal support for creating the new business unit and renewing the novel design capabilities.

This implication is counter-intuitive because the process of capability development is expected to follow the order of capability renewal, reuse and reinforcement. For example, Montealegre (2002) made the argument in his proposed process model of capability development that "actions that support the development of the firm's capabilities to integrate and engender trust (such as gaining internal commitment, investing in complementary infrastructure, and strengthening external relationships) seem to contribute the most in the final phase of strategy formation and implementation". In our case, the capability renewal was executed at the forefront of the whole process, but activities of both capability reuse and reinforcement didn't await the settlement of capability renewal. Admittedly, some events recording media's attention on Arup's activities was due to the high political profile of the Dongtan project bridging UK and China. However, a number of interviewees from both within and outside of the organisation indicated that Arup proactively and strategically leveraged public media attention to increase the influence of the Dongtan project as well as their novel design ideas 'in the making'.

Therefore, the early take-off of capability reinforcement activities provides important implications for the sequencing of capability development activities in an emerging market context. Since the markets are full of uncertainties and ambiguities, organisations have faiths that achieving first-mover status brings important competitive advantages and engaging institutional effects to accelerate and entrench the first-mover advantage becomes crucial (Lieberman and Montgomery 1988, Suarez and Lanzolla 2005). Organisations start to reinforce and institutionalise their capabilities at an early phase so as to provide social and political turf both internally and externally for capability renewal. Moreover, gaining internal support and enhancing sphere of external influence involve a time-consuming and gradual process. Although capability renewal activities are deliberate and intended for organisations'

strategy implementation, early engagement of capability reinforcement would provide time scope for future learning and feedback, especially in such an ambiguous and unstable market setting.

3.6 Conclusion

Management scholars have continually worked to explain the reason behind the enterprise-level competitive advantage over time in high-velocity markets (Eisenhardt and Martin 2000). The conception of the dynamic capabilities framework abstracts the source of enterprise success in fast-moving business environments through highlighting the notion of capability change, however, the recent evaluation of the literature has questioned the compatibility of allocating both 'rigidity' and 'flexibility' within one concept (Schreyögg and Kliesch Eberl 2007). Leonard-Barton (1992) theorised such conflict as a "capability rigidity paradox, where existing capabilities provide the basis for a firm's current competitive position, without renewal, these same capabilities become rigidities constraining the firm's future ability to compete".

Our interest in understanding the organisational phenomena has led us to study an empirical case to examine the processes by which organisations have attempted to 'redefine, renew and remake themselves' in a nascent market setting (Zahra, Jennings et al. 1999). We uncover three generative sets of activities which disaggregate but also constitute the notion of dynamic capabilities enabling organisations to develop capabilities needed to succeed in nascent markets. We found that it takes the first step 'renewal' to act as the instigation for the whole process, and two discernible steps 'reuse' and 'reinforcement' to dictate how to combine and define a complete and viable pathway to develop capabilities in achieving competitive advantages. We then include the three interrelated sets of activities in a cross-sectional

conceptual model of capability development in nascent markets and discuss the timing and sequence of implementing the three 'R' activities.

This paper makes four contributions to theory and practice. The first contribution lies in offering opportunities to dissolve and transcend the inherent paradoxical issues in the notion of dynamic capabilities. While acknowledging the merits of uncovering the three conceptually distinctive activities to dissolve the opposition between 'flexibility' and 'rigidity', we also cast doubts about an organisations' ability to separate elements of stability and change so neatly. Through the analysis of interdependences and complementarities among the three seemingly paradoxical activities, we explain how stability and change may intertwine rather than negate or displace each other in the process of capability development.

Second, our study examined the capability lifecycle model proposed by Helfat and Peteraf (2003) in an empirical context. Helfat and Peteraf depicted organisations confront selection events which could lead to six different branches of capability transformation. Although the lifecycle model generally explains under what conditions organisations are likely to make specific branch selections of the capability lifecycle, it lacks empirical studies on the process of capability development to achieve sustained competency. Moreover, Helfat and Peteraf did not elaborate the dynamic interactions among those different branches. This paper has taken this issue a few steps further. Firstly, the study employs the most rapid changing market condition, an emerging eco-city market as our research setting to empirically explore the process of capability development. Secondly, compared to Helfat and Peteraf's (2003) lifecycle model, our conceptual model introduces a new component, capability reinforcement which forms the essence of firms' response to the pressure of market emergence.

Third, our paper makes a contribution to the organisational capability literature. Past literature in organisational theory on the topic of organisational responses to external pressure focused on organisational change provoked by exogenous forces. Although scholars working on

institutional theory have highlighted how 'institutional entrepreneurship' actions empower organisations to influence and transform the institutional environments (Oliver 1991, Oliver 1992, Lawrence 1999), the endogenous forces of capability development process shaping the external environment have rarely been discussed in organisational theory. The introduction of the activities of *capability reinforcement*, which stresses gaining both internal support and external legitimacy, offers an institutional perspective of dynamic capabilities (Dunning and Lundan 2010).

Fourth, the paper makes a contribution towards managerial practice especially in emerging sustainability related domains. From a practitioner's point of view, this study provides managerially actionable strategies which can be individually or holistically employed at different phases of market formation. The mechanisms underpinning each strategy can help organisations to reinvent themselves and achieve dominant positions in the evolving green business. The discussion about the sequence of three 'R' activities can absorb managers' attention before their strategy implementation.

The paper also has limitations which provide opportunities for future research. Since we place emphasis on the initiatives and mechanisms enabling capability development through innovations at firm level, the paper is limited due to its deemphasizing the exogenous factors at the field level. When the activities of *external capability reinforcement* is introduced as a bridge to demarcate and communicate with the external environment, we acknowledge the process of the reinforcement activities may be well analysed in the context of institutional theory, which opens the opportunity for the following research. Secondly, our paper is limited to the adoption of a single in-depth case study. Case studies by definition focus on small samples of firms or individuals compared to statistical analysis, therefore the findings of case studies might not be able to be generalized to population phenomenon. Thus, it would be valuable to examine and compare how the three sets of activities play differently in other market conditions including both high-velocity markets and low-velocity markets. The

extension to different empirical settings and comparative longitudinal studies would provide additional theoretical implications for the process of capability development. We are interested in adopting a thorough longitudinal approach to understand the sequences and timing of action implementation. For example, identifying the contingency effect on the sequence of undertaking the three 'R' activities would largely assist the understanding of effective capability development across various contexts.

Appendix 3.1 – List of Interviews Recorded and Transcribed

Code	Date	Affiliation	Interviewee's Job title/Function	Description
1	September 2007	Arup Arup	Director of Planning Project Manager of Dongtan project	Face to face, UK
2	February 2008	Arup	Project Manager of Dongtan project	Face to face, UK
3	February 2008	Arup	Senior Architect	Face to face, UK
4	February 2008	SIIC	Client	Face to face, UK
5	February 2008	Arup	Senior Urban Designer	Face to face, UK
6	February 2008	Arup	Head designer of Dongtan Integrated Urbanism	Face to face, UK
7	February 2008	Arup	Senior Urban Designer	Face to face, UK
8	February 2008	Arup	Senior Economist, Associate	Face to face, UK
9	March 2008	Arup	Cultural planner	Face to face, UK
10	March 2008	Arup	Senior Environmental Consultant	Face to face, UK
11	March 2008	Arup	Senior Energy Engineer	Face to face, UK
12	March 2008	SIIC	Client	Face to face, China
13	March 2008	SDC Investment	Investment Consultant	Face to face, China
14	March 2008	Arup	Network Coordinator	Face to face, China
15	March 2008	Monitor Consultants	Consultant	Face to face, China
16	March 2008	Arup	Network Coordinator	Face to face, China
17	March 2008	Tongji University	Advisor to Shanghai Municipality on Dongtan project	Face to face, China
18	March 2008	Tongji University	Professors	Face to face, China
19	March 2008	SIIC	Client	Face to face, China
20	March 2008	Arup	Network Coordinator	Face to face, China
21	March 2008	Arup	Project Manager	Face to face, China
22	March 2008	Shanghai Municipality	Government Officials	Site Visit and meeting

23	April 2008	Arup	Project Manager	Face to face, UK
24	April 2008	Arup	Team leader in environment and sustainability design	Face to face, UK
25	April 2008	Arup	Senior Urban Designer	Collaboration meeting
26	April 2008	SDCL	Founder	Face to face, UK
27	May 2008	Arup	Global Head of R&D department	Face to face, UK
28	May 2008	Arup	Senior Urban Designer	Face to face, UK
29	May 2008	Arup	Economist, Associate Director	Face to face, UK
30	May 2008	Arup	Head of Energy Strategy, Managing Director	Face to face, UK
31	July 2008	Arup	Water strategy consultants	Face to face, UK
32	July 2008	Arup	Global Head of R&D department	Face to face, UK
33	July 2008	Arup	Energy strategy, Director	Face to face, UK
34	July 2008	Arup	Consultant	Telephone
35	July 2008	Arup	Project Director, Director of Planning	Face to face, UK
36	July 2008	Arup	Director of Communication	Face to face, UK
37	July 2008	Arup	Logistics, Associate Director	Face to face, UK
38	July 2008	Arup	Project Manager	Face to face, UK
39	July 2008	Arup	Project Manager	Face to face, UK
40	August 2008	Arup	Network Coordinator	Face to face, China
41	August 2008	SIIC	Vice President	Face to face, China
42	August 2008	Academics, SIIC and Arup	Workshop in Shanghai	Workshops
43	August 2008	SIIC	Manager	Face to face, China
44	August 2008	SIIC	Manager	Face to face, China
45	March 2009	Arup	Project Director, Director of Planning	Face to face, UK
46	March 2009	Arup	Senior Architects	Face to face, UK
47	March 2009	Arup	Senior Urban Designer	Face to face, UK
48	March 2009	Arup	Project Manager	Face to face,

				UK
49	March 2009	Arup	Dongtan design leader, Associate Director	Face to face, UK
50	June 2009	Arup	Sustainability Consultant, Director	Face to face, UK
51	June 2009	Arup	Chairman, Energy, Resource and Industry Market	Telephone
52	July 2009	Arup	Senior Architect	Telephone
53	July 2009	UCL	Professor of Planning	Face to face, UK
54	July 2009	Arup	Innovation, Associate Director	Face to face, UK
55	July 2009	Arup	Project Director, Director of Planning	Face to face, UK
56	May 2010	Arup	Workshop	Face to face, China
57	May 2010	Chongming Government	Workshop	Face to face, China
58	May 2010	Chongming Developer	Workshop	Face to face, China
59	May 2010	Tongji University	Professor of Architecture	Face to face, China
60	May 2010	Jinshan District Government	Workshop and field visit	Workshop
61	May 2010	Bluepath Consulting	General Manager, Senior Manager	Face to face, China
62	May 2010	Tongji University	Professor of Policy and Economics	Face to face, China
63	May 2010	Arup	Principle Senior Engineer	Face to face, China
64	May 2010	SIIC	Vice President	Face to face, China
65	May 2012	Arup	Senior Urban Designer	Telephone

Appendix 3.2 – Arup's Three 'R' Activity Events from 2005 to 2010

In this appendix, we illustrate the key milestone events in related to Arup's involvement in the emerging eco-city market over a period of five years (2005-2010). We categorise the events into the three sets of 'R' activities for Arup's capability development based on the following principle:

- Events categorised as Capability Renewal: events that describe Arup's involvement in delivering Dongtan project tasks. We consider these events constitute the process of Arup's renewal for integrated design capabilities.
- Events categorised as Capability Reuse: events that describe Arup's involvement in other eco-city projects during the period of 2005 – 2009.
- Events categorised as Capability Reinforcement: events that describe Arup's public relationship with legitimated institutes as well as media exposure of Arup's Dongtan involvement from top ranked UK and US newspapers. In this regard, the events are mostly for Arup's actions to externally reinforce its renewed capabilities. We didn't include the internal reinforcement events since most of the evidence are from interview quotes without a specific date.

However we could not categorise all of the events in 2010 into the three 'R' activities. This is because not all the events recorded in 2010 are directly related to the development of Arup's integrated design capabilities for eco-city planning. In particular, some of them indicate Arup's effort for developing other eco-business related capabilities instead of the integrated sustainable design capability, which is out of the scope of this paper. As such, we put the content of the events in 2010 as a background to triangulate the understanding of capability development via three 'R's.

Year Month	*Category of Activities*	*Project name*	*Descriptions of Activities*
2005			
Apr–Aug	Renewal	Dongtan	Five individuals from Arup spent 4 months on generating an initial urban development proposal to interact with the bird sanctuary. Arup submitted a strategic report after four months although they didn't really understand the full potential of the project.
Jun	Renewal	Dongtan	SIIC appointed Arup to develop the vision for Dongtan
Aug	Renewal	Dongtan	Arup issued First Vision for development
Nov	Renewal	Dongtan	Arup hired Peter Head on board who positioned Dongtan project at strategic level within Arup
	Renewal	Dongtan	Birth of new business unit within Arup - integrated urbanism planning
Dec	Reuse	Dongtan	Arup & SIIC relationship developed from the traditional Client Consultant role into a major framework that delivers sustainable development for SIIC and China (initiatives or framework for capability reuse)
2006			
Jan	Renewal	Dongtan	SIIC appointed Arup for conceptualizing Dongtan Energy Centre
Aug	Renewal	Dongtan	SIIC appointed Arup for masterplanning the Start-up Area (1,000 ha)
	Reinforcement	Dongtan	The Times and The Independent reported the Dongtan project
Sep	Reinforcement	Dongtan	Financial Times introduced the background of Dongtan and expressed concerns over the eco-city to be developed adjacent to bird wetland
Oct	Renewal	Dongtan	Arup submitted the Interim Report One
	Reinforcement	Dongtan	Financial Times compared the original eco-city concept with the Dongtan project masterminded by Arup.
Nov	Reuse & Reinforcement	Dongtan	SIIC, Arup signed MOU (planning) with Chinese President Hu & British Prime Minister Blair to develop the world's first "eco-city" and also collaborate on more sustainable development

			projects in the future
Dec	Renewal	Dongtan	Arup issued First Design Report for Start-up area and the report was approved by SIIC in Jan 2006
	Reinforcement	Dongtan	Guardian introduced the Dongtan project and the project director Peter Head.
2007			
Jan	Reinforcement	Dongtan	Since the brief report published in Dec 2006, Guardian interviewed Arup's Dongtan project director and liaison executive in Shanghai and quoted their comments. The detailed report provided key facts about Dongtan including history, geography, environmental, technology and investment background.
Mar	Reuse	Tangye	SIIC and Arup signed agreement and started work on 500ha masterplan and 1800ha control plan
Apr	Reuse	Northstowe	Arup started working on Northstowe project. Northstowe was the first project that Arup reused the IRM ICT tool invented from Dongtan project.
May	Reinforcement	Dongtan	The Independent reported Dongtan project and China's environmental challenges.
Jun	Renewal	Dongtan	Arup spent the past half a year and worked out on the Control Plan for the Dongtan development
	Reinforcement & Reuse	Dongtan	Guradian reported Dongtan project and London Thames Gateway plan. The report mentioned Arup's project director was also invited to provide advices to Ken Livingstone's sustainable development commission. Arup energy strategy director Chris Twinn was also mentioned in the report.
July	Renewal	Dongtan	HSBC proposed commercial development strategy for Dongtan eco-city could be based on education model
Sep	Renewal	Dongtan	Arup issued Control Plan document for Start-up area
	Reinforcement	Dongtan	The Times published a report to raise the awareness of the importance of marketing UK brands in the emerging market in China. It used Arup as a pioneering example which has done reasonably well in Chinese infrastructure industry. Dongtan and many other infrastructure projects were mentioned as a part of Arup's portfolio.

	Reinforcement	Dongtan	Guardian wrote a report to analyse the feasibility for China to go green. The report used Dongtan project as the example and quoted Arup's responses
	Reinforcement	Dongtan	Financial Times reported water, recycling and waste management in the Dongtan project.
Oct	Reinforcement	Dongtan	The Times' report used Dongtan as the beacon to achieve a low carbon future. The report also mentioned London mayor visited Dongtan before he made the decision on the regeneration of east end gaswork area in London
Nov	Reuse	Wanzhuang	SIIC and Arup signed agreement for delivering the first phase of Wanzhuang eco-city
Dec	Renewal	Dongtan	Arup issued Sustainable Design Guidelines for Dongtan project
Dec	Renewal	Dongtan	Arup integrated economic models into the holistic design package for the first time
2008			
Feb	Renewal	Dongtan	Arup issued Implementation Report
	Reinforcement	Dongtan	The Independent published a report on China's 'green leap forward' by quoting the comments from Peter Head and Chris Luebkeman, Head of Arup's global foresight and innovation initiative.
Mar	Reinforcement	Sustainability Statement	Arup published a summary of its sustainability approach and performance from 1 April 2007 to 31 March 2008.
Apr	Reuse	Wanzhuang	SIIC and Arup signed main contract
	Reuse	Zhujiajiao	SIIC and Arup signed first agreement
	Reuse	Huzhou	SIIC and Arup signed first agreement
	Reinforcement	Dongtan	Deputy PM John Prescott visited Dongtan site
	Reinforcement	Dongtan	Wired Magazine reported how Arup won Dongtan Project against other competitors and how the firm assembled the first project team
May	Reinforcement	Dongtan	The Times suggested Dongtan and Masdar project were the two projects competing to be the world's first 'eco-city'. Arup's director Peter Head's report'from industrial age to ecological age' were mentioned.

	Reinforcement	Dongtan	The Independent published an article written by Arup's director Peter Head on how Arup delivered Dongtan eco-city project.
	Reinforcement	Dongtan	Financial Times published an article suggesting the form of Eco-towns can settle the sustainability and housing problems for politicians. Peter Head's vision was quoted.
Jun	Reinforcement	Dongtan	Financial Times listed Arup's Dongtan model as one of the examples for a new city model.
Jul	Reuse & Reinforcement	Dongtan	The Times unveiled that Arup would be the designer behind Brown's 10,000 home development in UK.
Aug	Reuse	Sustainability Statement	Arup, commissioned by Forth Properties Ltd published a sustainability statement for Outline Planning Application for Leith Docks
	Reinforcement	Dongtan	China and UK universities formed educational partnerships (EPSRC, Cambridge and Weizmann)
	Reinforcement	Dongtan	DPM visited Dongtan followed by HSBC liaisons with UK government
Aug	Reuse	Stratford	Arup finished the work on Stratford planning project
Sep	Reinforcement	Dongtan	Arup and HSBC presentation to PM Brown and China Task Force
	Renewal	Dongtan	Arup and HSBC presentation on Phase 1 proposals to SIIC
	Renewal & Reuse	Ebbsfleet	Arup started working on Ebbsfleet planning project. The parameters, concepts and IRM developed from Dongtan were tested and reused. The whole optimising process of gaining information from digital modelling to make information work coherently in IRM model was repeated three times in Dongtan but only two times in Ebbsfleet project.
Oct	Renewal	Dongtan	Arup delivered Phase 1 Feasibility Report
Nov	Reinforcement	Dongtan & Masdar	The Times compared two different models of sustainable development between Dongtan and Mazdar city
	Reinforcement	Dongtan	The Independent published the second article written by Arup's director Peter Head on how Arup delivered Dongtan eco-city project.

Dec	Renewal	Dongtan	Arup delivered Issues of Site Plan
	Reinforcement	Dongtan	Financial Times published the first article criticising the eco-credentials of the Dongtan project
No specific month available	Renewal	Dongtan	Arup gained the experiences of how to take financial management considerations into the holistic account, i.e. large scale financial model being introduced into the project. The interests of different stakeholders need to be looked at and balanced.
	Reuse	Zhujiajiao	Arup to work on 340ha integrated planning and development strategy for Zhujiajiao area. The project is a part of the collaborative framework between Arup and SIIC.
	Reuse	Huzhou	Arup to work on 60km^2 control plan review and 6.3km^2 conceptual plan for Huzhou area. The project was a part of the collaborative framework between Arup and SIIC. Arup reused the waste strategy developed from Dongtan in Huzhou project and improved it.
	Reuse	Zuidas	Arup was appointed by Zuidas-DOK to provide joint leadership with DRO in setting out the strategic guiding principles and ambition for the future of Zuidas city within Netherlands. Arup's work scope includes sustainability strategy, masterplanning, transport planning and interchange design.
2009			
Jan	Reuse & Reinforcement	Dongtan	SIIC, Arup, HSBC, SDCL, Tongji University signed MOU (implementation) with Gordon Brown, Shanghai Mayor Han Zheng. A long-term strategic partnership was agreed upon to develop the funding model for eco-cities in China.
	Reinforcement	Dongtan	Guardian unveiled that Arup's director Peter Head was listed as one of the fifty people who could save the planet.
	Reinforcement	Dongtan	British Prime Minister Gordon Brown urged Chinese fund to invest in London. He used Dongtan project as an example of key collaboration between Chinese and UK's industry.
	Renewal	Dongtan	Up to this point, Arup produced a masterplan along with four volumes of sustainable guidelines

			for Dongtan that included key aspects related to ecological management of wetlands, energy, resource and waste management, buildings, transport and sustainability.
Mar	Reuse & Reinforcement	Blackburn Meadows Renewable Energy Plant	Arup published a Sustainability Statement on Blackburn Meadows Renewable Energy Plant project for the client E.ON via using Dongtan's sustainability framework
Jun	Reinforcement	Dongtan	Financial Times argued an eco-town like Dongtan on greenfield was not sustainable
Jul	Reinforcement	Dongtan	Financial Times indicated Dongtan as an example that Eco-city had not begun to shape.
Sep	Reinforcement	Dongtan	Guardian reported that China's Dongtan project was listed as one of the ten facts of architecture knowledge in 2008.
Oct	Reinforcement	Dongtan	Financial Times argued that Eco-cities might not be the best solution to sustainability problems. Dongtan was mentioned as the first key eco-city example.
	Reinforcement	Public presentation	Arup design director Alejandro Gutierrez spoke at the Royal College of Art in the spring of 2008. He acknowledged the loss of freedom that Dongtan's success will entail. But, as he stressed, managing energy consumption in the face of global warming overwrites the needs of democracy. It is not just utopias, it seems, which require dictators.
	Reinforcement	Dongtan	Telegraph reported that the plans for Dongtan have helped to raise Arup's profile considerably in China, allowing it to bid for other prestigious projects. The company has also vigorously promoted its eco-credentials in workshops and conferences around the world.
Nov	Reinforcement	Dongtan	Economist used Dongtan project as a non-first eco-city compared to Masdar.
	Reinforcement	Thames Gateway	Financial Times reported Arup director of R&D Jeremy Watson was involved in Thames Gateway project. Dongtan team formed partnership with Thames Gateway institute.
Dec	Renewal	Dongtan	Arup learnt the essence of capital risk mitigation from Dongtan project

	Reuse	Jeddah	Arup was commissioned to create a masterplan for the strategic development of a 'protected zone' of five square kilometres between the ancient centre and the waterfront. The design methods developed from Dongtan was reused in the project.
2010			
Jan	Reuse	Northstowe	Arup finished work on Northstowe project
Feb	Reuse	Wanzhuang	Arup finished work on Wanzhuang project
	Reinforcement	Thames Gateway	New Civil Engineer unveiled that Arup, Thames Gateway Institute for Sustainability and Tongji University signed a Memorandum together
	Reinforcement & Reuse	MOU between Wuhan and Arup	Arup official website stated that Arup lead UK and China collaboration on sustainable masterplan. Arup and the Administrative Committee of China's Wuhan Economic & Technology Development Zone (WEDZ) signed a Memorandum of Understanding for the masterplanning of a 'Demonstration Industrial Park for Energy Saving and Environmental Protection'.
Mar	Reinforcement (influence loop)	Dongtan	Economist published an article stating Dongtan project was still on drawing board.
Apr	Reinforcement (influence loop)	Dongtan	Guardian reported that the dream of the first eco-city Dongtan was built on a fiction
May	Reinforcement	Eco-city philosophy	Financial Times unveiled that Peter Head, director of global planning at Arup, suggested part of the work Arup was doing in China on sustainable building and development had involved workshopping philosophical ideas from Taoism.
	Reinforcement (influence loop)	Dongtan	Far Eastern Economic Review reported that construction of eco-cities like Dongtan Eco-city on Chongming Island have stagnated due to poor planning that did not take into consideration the needs of local residents, while miscommunication among foreign investors and firms that had little understanding of Chinese building procedures and politics resulted in shoddy project oversight.
	Renewal	City-wide	Architecture and Design reported that Arup called on a city-wide retrofit. The Brisbane

		retrofit	retrofit project draws on research carried out by Arup director Peter Head's 'Entering an Ecological Age'.
Jun		Clinton C40 initiative	Building & New Civil Engineer disclosed that Arup and Bill Clinton joined forces to fight climate change. Arup would help 40 of the world's largest cities tackle climate change after signing an agreement with the Clinton Climate Initiative (CCI) and the C40 group of cities.
		Flordia eco-city	The Times uncovered that Arup helped Destiny drew up a plan for Ecocity in Florida which was branded to be hub of green technology
	Reinforcement	Public presentation	Design London reported that Alejandro Gutierrez, the leader of four major eco-city projects across China and other international projects gave a presentation on Eco-Cities, Entrepreneurship and the Zero Emission Challenge.
	Reinforcement	Public presentation	Building reported that Arup's new chairman publicly expressed optimistic about Eco markets in China
		Retrofitting property council of Australia	Davis Langdon unveiled that Arup leaded industry calls on refurbishment to avoid obsolescence.
	Reinforcement	Public presentation	London Development Agency quoted Peter Head's word: "*I am delighted that it has been possible to use Arup's methodology, developed in China, to help move London's first zero carbon project forward really quickly."*
Jul		Algae Power	The Engineering Online unveiled that the idea of using Algae power originated from the Dongtan project was developed with process and systems engineers from the CPI.
Aug	Reuse & Reinforcement	Portbury Dock Renewable	Arup published a sustainability framework report for E.ON Climate and Renewables UK Development Limited based on the previous Dongtan framework
Sep		City as living factor of ecology	Cluster reported that Arup won cities of the future competition with other alliances
		Helsinki Carbon-	Arup helped to win a real estate project competition by injecting financial model into

	neutral real estate	sustainable design
Oct	Public Presentation	Peter Head, Arup director gave presentation series - Urban Age with the Ove Arup Foundation Cities and the Environment
	Public Presentation	Dr Jennifer Greitschus of Arup Global Foresight gave Sustainable lectures
Dec	Mayor Summit	Arup's planning director Peter Head was involved in the Mayors Summit which brought at least 60 mayors from the world's largest cities together to address that cities and regions could lead the low carbon revolution.

Table 3.2 Arup's three 'R' Activity Events from 2005 – 2010

Chapter 4

ESTABLISHING NEW PRACTICES IN NASCENT FIELDS

Incumbents' leverage of a boundary infrastructure

ABSTRACT

The study approaches a theoretical puzzle in institutional theory, the paradox of embedded agency, by dismantling the process that established organisations used to overcome their existing constraints and institutional environments to successfully enter nascent fields. The paper bases the theorizing on the strengths of a qualitative study that employs interviews and media article data to track how an established organisation, well known in the built environment, successfully entered the emerging field of eco-city planning (ecological urban development) and achieved a dominant position over a five-year period. Through the study, it was determined that to establish novel practices in a nascent field organisations take a combined adoption approach including market-focused and socio-political means. The paper introduces a strategic mechanism: a *boundary infrastructure* (contains a system of boundary objects (Carlile, 2002)), on which established organisations rely to offer the promise of adopting both market-focused and socio-political approaches. Taken together, the study finds the ways in which different characteristics of boundary infrastructures underpin organisations' deliberate and emergent strategies when, during the earliest phases of field emergence, there is the co-existence of heterogeneity and cooperation.

Keywords: market actions, socio-political actions, institutional entrepreneurship, boundary objects, boundary infrastructure, nascent markets

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4.1 Introduction

Since Aldrich and Fiol (1994) claimed that researchers should focus intensively on the initial years after a new industry is established, management scholars have called for attention to be paid towards agency's actions during the early periods of a field's emergence (Stinchcombe 1965, Van de Ven and Garud 1987, Aldrich and Fiol 1994). Nascent fields pose unique market and institutional challenges for organisations as they are full of ambiguities and uncertainties when compared to established mature fields (Maguire, Hardy et al. 2004). Prior studies related to the process of field emergence concentrated on entrepreneurial actions carried out by new ventures (Leblebici, Salancik et al. 1991, Zimmerman and Zeitz 2002, Hensmans 2003, Lounsbury, Ventresca et al. 2003, Maguire, Hardy et al. 2004, Maguire 2007, Petkova, Rindova et al. 2008) rather than on such activities performed by established organisations starting to operate in new industries. This is not surprising as new entrants positioned at the periphery of a field (Leblebici, Salancik et al. 1991, Rao, Morrill et al. 2000) are more likely to bridge the boundaries of multiple fields (Greenwood and Suddaby 2006) and hold the motivation to grasp new field opportunities (Zilber 2002). While, on the contrary, established organisations are likely to lack the motivation to enter new fields, despite having adequate resources, as they are highly embedded on their existing fields (Sherer and Lee 2002). Thus, the instances of established organisations moving away from their embedded fields and establishing new practices to shape new fields are not common.

Some scholars have realised the value of studying incumbents' entry into nascent fields because it helps to resolve the paradox of the embedded agency in institutional theory, which alludes to the tension between agency and structure (Holm 1995, Seo and Creed 2002). For example, King and Tucci (2002) examined the competitive effect of technology innovation and organisational experiences on incumbent firms' entry into new markets in the disk-drive

industry, but their paper does not explain the process of how incumbents successfully entered new markets. Fligstein (1996) made suggestions about how incumbent firms undertake political actions to convince other firms to go along with their conception of a new market, but the conceptual paper does not unpack the political process of establishing institutional projects. Therefore, it is possible to develop a fuller understanding of field emergence and the issue of a shift in an agency's embeddedness through studying the process of incumbent firms entering a nascent field. We seek to create new insights by asking: *How do embedded established organisations develop dominant practices to shape the formative process of nascent fields?*

Incumbents' entrepreneurial actions, will be examined in this paper, in nascent fields that account for the high embbeddedness of the incumbent firms to resolve part of the paradox of the embedded agency. We base our theorizing on the strengths of a qualitative study that employs interviews and media article data to track how an established organisation, well known in the built environment, successfully entered the emerging field of eco-city planning (ecological urban development) and achieved a dominant position over a five-year period. Through the longitudinal research design used in this study it is determined that to establish novel practices in a nascent field organisations take a combined adoption approach including market-focused and socio-political means. The market-based approach *deliberately* disrupts a market through the demarcating of new practices; the socio-political approach helps to carry on the *emergent* turbulences initiated by market-focused activities and mobilizes influential non-field actors to support the institutional framework being promoted. The theoretical contribution from this report lies in the introduction of a strategic mechanism: a *boundary infrastructure* (contains a system of boundary objects (Carlile, 2002)), on which established organisations rely to offer the promise of adopting both market-focused and socio-political approaches. The nature of modularity and repository in a boundary infrastructure (Star and

Griesemer 1989, Carlile 2002) enables organisations to claim the nascent field as cognitively familiar and trustworthy; while, the interpretive flexibility of a boundary infrastructure (Pinch and Bijker 1984, Star 2010) facilitates organisations to engage collective effort with influential actors in social and political construction of the nascent field. Also, the paper contributes to the literature on institutional entrepreneurship (Maguire, Hardy et al. 2004, Greenwood and Suddaby 2006) by articulating a mixed set of 'deliberate' and 'emergent' strategies that are particularly effective for entrepreneurial actions in a nascent field associated with high levels of uncertainty. This research found the ways in which different characteristics of a boundary infrastructure (containing a system of boundary objects) underpin organisations' entrepreneurial actions for implementing strategies to compete when, during the earliest phases of field emergence, there is the co-existence of heterogeneity and cooperation among field actors.

4.2 Theoretical Context

4.2.1 Challenges Confronting Incumbents in Nascent Fields

New fields arise when "organised actors with sufficient resources see in them an opportunity to realise interests that they value highly" (DiMaggio, 1988:14). The lack of institutionalized practices in new fields poses unique market opportunities and institutional challenges including conflicting values, unclearly defined norms and tensions in the inter-organisational relationships (Maguire, Hardy et al. 2004). The emergence of a field involves individual and collective efforts to make technological disruptions commercially viable, social solutions to perceived problems regulated and legitimated, and new practices and ideas institutionalized (Van de Ven and Garud 1987).

Past studies suggest there are two main challenges confronting established organisations that try to enter, grown and compete in nascent fields. The first challenge lies in the relative swing between agency and embeddedness (Seo and Creed 2002). For an established organisation rooted in its relatively mature field, moving across its organisational boundaries and entering a nascent field is difficult. In this sense, the established organisation is challenged to execute *boundary work* to create, expand, or disrupt its organisational boundaries (Gieryn 1983, Bechky 2003, Zietsma and Lawrence 2010) organisation. Although existing theory of organisational boundaries has addressed nascent fields provide an intriguing market setting in which opportunities and challenges co-exist for new ventures (Santos and Eisenhardt 2009), the literature stream does not sufficiently explain how early entrants, i.e. an established organisation, succeed to move across their boundaries to enter nascent fields.

Secondly, for those organisations having successfully bridged the boundaries, institutionalising their novel practices to become dominant beliefs in uncertain market conditions is challenging. In nascent fields, products definitions are unclear or unknown (Hargadon and Douglas 2001), technologies or processes are "untested and incompletely understood" (Tushman and Anderson 1986), industry structure is ambiguous or ill-structured (Santos and Eisenhardt 2005) and competition and regulations are neither identifiable nor initiated. Any entrepreneurial organisation aiming to promote and institutionalise new practices need to overcome the difficulties of addressing lack of stable roles and relationships and defining social norms and belief systems where legitimated standards do not exist. For the purpose of achieving dominant positions, organisations take on the challenge of completing a potent institutionalization project – to institutionalize their own status as well as the nascent fields (Suchman 1995).

4.2.2 Entrepreneurial Actions in Nascent Fields

Nascent fields are characterized by multiple conceptions of control proposed by various organisational actors (Fligstein 1996). The emergence of a new field is institutionalized through reciprocal effects of market and institutional activities (Scott, 1995; Suddaby & Greenwood, 1999) whose relative emphasis can shift over time (Peng 2003, Navis and Glynn 2010). Existing studies indicate that organisations frame ambiguities and uncertainties in nascent fields into more comprehensible terms and take entrepreneurial actions to legitimate their alternative rules, practices or logics they are championing in nascent fields (Smith and Cao 2007, Ozcan and Eisenhardt 2009). For example, developing rhetorical discourses to frame entrepreneurs' novel logics (Suddaby and Greenwood 2005), manipulating and creating rules, norms and values (Zimmerman and Zeitz 2002), delivering stories to legitimize organisational identities (Lounsbury and Glynn 2001), performing symbolic actions to acquire resources for new ventures (Zott and Huy 2007), and adopting a rule-based, impersonal exchange, and market-centred strategy (Peng 2003). Organisations benefit from these actions by getting their dominant identities appreciated (Scott 2001, Glynn and Abzug 2002) and social status legitimated (Fligstein 1996).

Studies of institutional entrepreneurship tend to conceptualise the entrepreneurial actions with two themes: organisations *individually* legitimate novel practices or products to dominate the field in its formative phases; and forge affiliations to orchestrate efforts for *collective* actions (Knight 1992, Wijen and Ansari 2007). Other studies categorise the entrepreneurial actions to be in line with different types of legitimacy pressure (Suchman 1995). For instance, Scott's (1995) three 'pillars' supporting an institutional environment, regulative, normative and cognitive institutional pressure, provide three "related but distinguishable bases of the legitimacy". Peng (2003) emphasises regulative, normative and cognitive pressures compel organisations to engage in legitimating process, while Greenwood et. al (2002) suggest

normative, pragmatic and cognitive legitimacy is achieved at various stages of the whole process of institutional transition. Aldrich and Fiol (1994) point out that it would be cognitive and socio-political legitimacy to achieve during industry creation phase when entrepreneurial organisations 'carve out a new market, raise capital from sceptical sources, recruit untrained employees, and cope with other difficulties stemming from their nascent status' .

This, past studies reveals that entrepreneurial actions involving creating a vision, forging inter-actor ties, and engaging in discourses (BATTILANA, Leca et al. 2009). Among them, most studies place emphasis on the entrepreneurial actions of new ventures in nascent field or established firms in mature fields (Sherer and Lee 2002, Townley 2002, Greenwood and Suddaby 2006). This is because resource-poor new ventures are more likely to enter or create new fields in their favour, while highly embedded organisations subject to existing regulative, normative and cognitive pressures find it challenging to abandon existing practices in favour of new ones. However, the process of highly embedded organisations mobilizing field and non-field actors to realise and sustain the promoted vision in the context of nascent fields, that is, to institutionalize new practices, have been much less studied. As such, our research aims to lay the empirical groundwork for understand the process of how established organisations are motivated to become the early entrants to the new field, and undertake distinctive entrepreneurial actions to establish new practices.

4.3 Methodology

To answer our research question, we conduct a qualitative and in-depth case study of an established firm's entrepreneurial activities during the emergence of a nascent eco-city development field (Glaser & Strauss, 1967; Yin, 1989). We consider the adoption of an empirically grounded, and inductive qualitative methodology is appropriate because the contextualization (i.e. the context of emerging fields) is particularly influential in our

understanding of incumbents' entrepreneurial actions. The case that Arup, a well-established engineering-based firm in the built environment, entered its unfamiliar sustainable planning territory, and established new design practices as emerging institutional belief and standards is unusual and novel (Siggelkow 2007). In particular, it was Arup's entrepreneurial effort of not only overcoming scepticism on their technical ability but also tackling social and political challenges of operating in a developing economic country in far east that make the case unique and unparalleled (Yin 1994). Therefore, we undertake an in-depth study on a single case in order to uncover the complex dynamics between the organisation and the nascent field. We examine the process of the organisation's field work and take the contextual factors of the emerging eco-city design field as well as the developing economic market conditions into account. We capture and analyse a sequence of events taken place over time that combine elements leading to an outcome (Lieberman and Montgomery 1988), and specify certain conditions of interactions between the organisation and the context.

4.3.1 Data Collection

We employed a grounded theory approach (Strauss and Corbin, 1990) to collect data about Arup's entrepreneurial actions in the eco-city field over a period of five years, from 2005 when the Dongtan project began to 2010 after Arup completed the project delivery. We collected our data from a variety of sources including online media articles, semi-structured interviews, site-visits and nonparticipant observation, and archival documents. We triangulated these datasets to reduce bias from recall and rationalization.

Online media data

We searched online media for coverage of Arup and the Dongtan project as the primary source of our dataset. This dataset is composed of 269 newspaper articles, podcasts and annual reports in related to Arup's eco-city involvement spanning over 2005 - 2010. We searched 'eco-city' or 'ecocity' in the top 5 UK and US mainstream newspapers over a five-

year window and returned 239 (UK) and 123 (US) news articles. Occasionally, these releases lacked relevant content (e.g., the articles talked about Eco-city Vehicle instead of ecological city in the meaning); we removed the noise from our sample (n=35 for UK and n=65 for US), leaving 211 UK and 58 US news articles for analysis.

We were aware of the ongoing debates and potential limitations on the utility of the dataset such as 'selection bias' and 'description bias' (Sewell Jr 1992). To solve the dilemma, we collected both media sources and electronic archives such as annual reports and podcasts. We accessed multiple media sources to carry out the selection process randomly and longitudinally across the five year timeline (2005 – 2010) (Ozcan and Eisenhardt 2009). We organised the whole dataset by time sequence as well as the names of publishers, and highlighted all strategic decisions made by the firm into a chronological event chart. We categorised the data into different units of analysis and structured them into related categories to make interpretation more accurate.

Semi-structured interviews

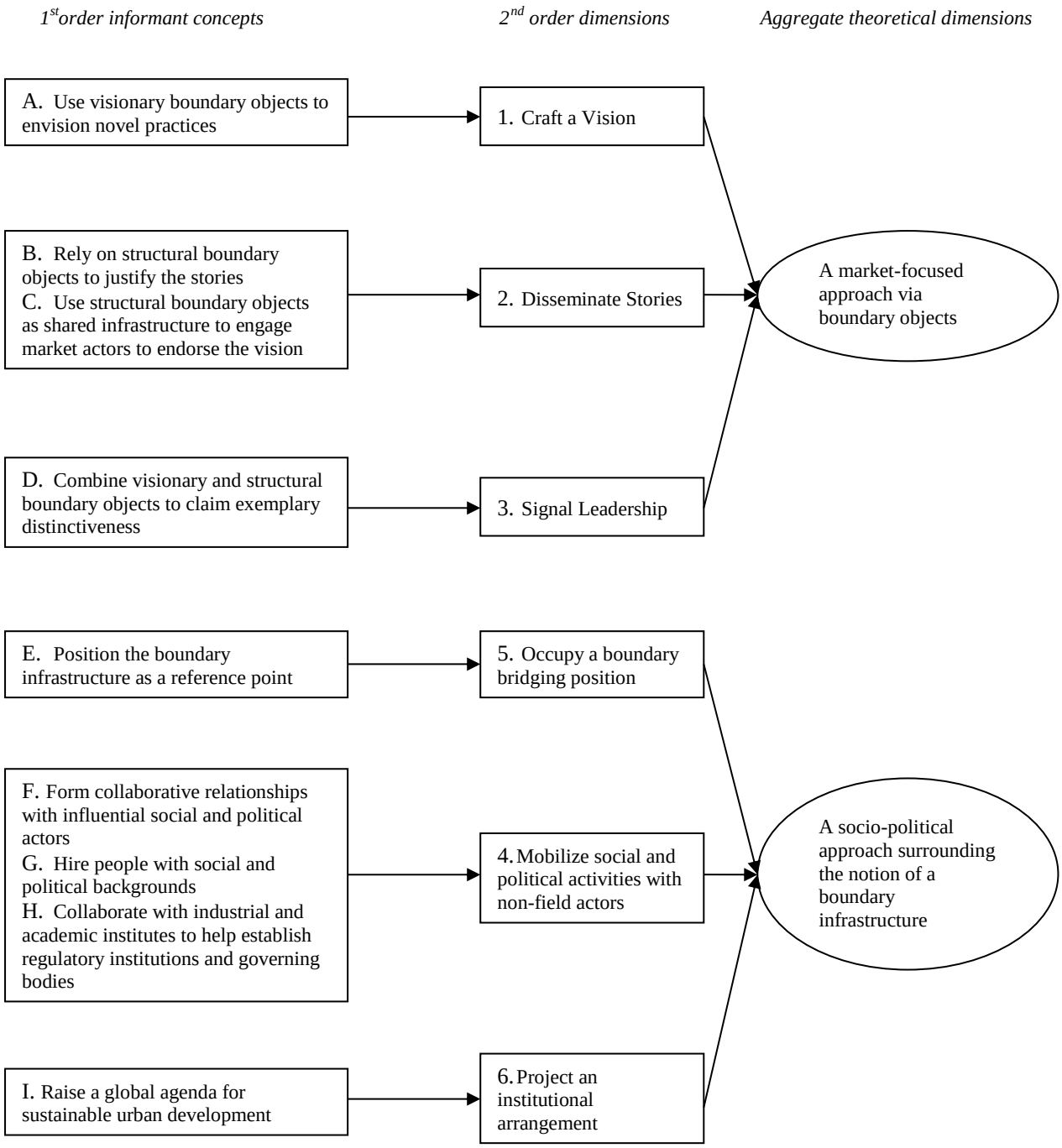
The online media and archival datasets were augmented by 65 semi-structured interviews with a wide range of informants, including senior and project managers in Arup from the UK and China offices, local Chinese academics, practitioners and policymakers, and senior managers in the client organisation. We asked interviewees about their perceptions of organisational identity change, strategic intentions and actions in its external market. These interviews provided important background information about Arup's involvement in Dongtan project as well as the insights into the relationship between other field/non-field actors and the strategic direction that Arup sought to manoeuvre their venture (See Appendix 4.1 for the list of recorded interviews and notes).

4.3.2 Data Analysis

Our data analysis proceeded in three stages. In the first stage, we followed Langley's (1999) narrative approach and Aldrich and Fiol's (1994) instruction to understand the historic origins of professional planning practice (Tushman and Anderson 1986, Selznick 1996, Zuckerman 1999, Lawrence and Phillips 2004, Santos and Eisenhardt 2005). As Selznick (1996) emphasised, a holistic and contextual approach has to be taken to include the "natural history" of a changing field. In doing so, we reached a clear idea why Arup's novel market solutions outmuscled the historical planning practices in respond to the emergence of a nascent field. In the second stage, we focused on how Arup's novel market solutions changed the historical planning practices, which involves who interacted with whom, in what ways, and at what times. We drew on the various accounts of our datasets to convert Arup's strategic decisions along timeline into an event chronology coded in multiple ways (Appendix 4.2). To build such an "event history database", we assembled large amount of the information into simultaneous representation to show the precedence, parallel processes and the passage of time (Langley 1999). Informed by a more articulated pattern of Arup's actions, we collated the coded informants' statements as well as Arup's public engagement into different categories of entrepreneurial activities by discerning similarities and differences (Van Maanen 1995). To reach saturation for each first-order informant concepts, we constantly compared contents across different interviews and media articles until no more distinct content emerged. In the third stage, we grouped the first-order informant concepts into second-order dimensions by repetitively making inferences between the raw data, the visual chronology map and relevant literature. At this stage, we discovered a strategic variable continuously appearing in a variety of Arup's entrepreneurial actions: a boundary infrastructure enabled Arup to bridge their boundaries with the nascent eco-city field, and also helped to occupy a boundary bridging position enabling the organisation's involvement in the social and political

construction of the nascent field. Such outcome guided another round of theoretical iterations and saturation until the first-order informant concepts was refined into second-order conceptual dimensions. We illustrated our data structure in Figure 4.1, highlighting informants' concepts and categories from which we developed a conceptual model in this paper. We also included representative data extracted from our multiple datasets as shown in Table 4.1, providing support for the data structure. In the final stage, we assessed Arup's media coverage in mainstream newspaper articles within the field of eco-city development over the five-year research period. We use the media coverage as an indicator to reflect Arup's organisational influences in the nascent eco-city field because past studies have demonstrated that firms and influential third parties including public media can co-create and define a field reality (Rindova, Petkova et al. 2007).

Figure 4.1 – Data Structure



2nd order dimensions and 1st order informant concepts	Representative data (interviews, archival documents and media articles)
Market-focused approach via boundary objects	
1. Craft a vision	
A. Use visionary boundary objects to envision novel practices	A.1 "Dongtan is a revolutionary concept in urban planning, which Arup and the Chinese see as a potential blueprint for ecologically sound city-building." (extract from the article by Frank Kane in the *Guardian*, 18th December, 2005) A.2 "Dongtan emerged as the solution, a visionary model that would serve as a prototype for sustainable urbanization in a country that needs to build 400 new towns to house 300 million people between now and 2020." (extract from the article by Slavin in the *Guardian*, 28th June, 2006) A.3 "'By integrating all these different technologies, we can create a new type of city living,' says Dong Shanfeng, who runs the project at Arup…There is not much to see yet, but by the 2010 World Expo in Shanghai the developers hope 25,000 people will be living there, rising to 80,000 by 2020. Eventually the eco-city could have a population of 500,000." (extract from the article by Geoff Dyer in the *Financial Times*, 15th September, 2006)
2. *Disseminate stories*	
B. Rely on structural boundary objects to justify the stories C. Use structural boundary objects as shared infrastructure to engage market actors to endorse the vision	B.1 "[Urban Information Management] is the new urban information management system we like to push into the market" (Volker, Director of IT and Business Consultancy, Arup) B.2 "I've got lots of examples of that, both inside and outside of Arup … for example, in the outside Arup bit, one of the first people I did a lot of presentations to were the Mayor's team in London. The, the GLA, the LDA teams who were thinking about London and they developed a London Climate Change Action Plan and lots of the thinking in it was actually really supported by what we did in Dongtan" (Head demonstrated 'Integrated Resource Model' and 'the system of city life' in numerous keynote speeches in between 2007 and 2009) B.3 Arup Peter Head published an media article 'A green revolution is taking place in China that could change the way we live' (extract from the article highlighting the story of Arup's Dongtan delivery in the *Independent*, 14th May, 2007 C.1 "you feed the market half of the information, and what happens is other people come to you talking, oh what did you do there, I did this on this project and that happened, well then, and what you're finding is they're bringing further bits to the jigsaw" (Malcolm, Director of Urban Design London, Arup) C.2 Arup Gary Lawrence presented 'integrated resource model' in the conference paper 'urban development to combat climate change: Dongtan Eco-city and Risk Management Strategies' at CTBUH 8th World Congress, Dubai, 3rd – 5th March, 2008
3. *Signal leadership*	

D.	Combine visionary and structural boundary objects to claim exemplary distinctiveness	D.1 "[Dongtan was the] ultimate demonstration which required and merged different packages that Arup were capable of" (Jeremy, Arup Global R&D director) D.2 "Dongtan's being probably one of the most amazing marketing bits for Arup that they ever could have hoped for [to demonstrate distinctive capabilities]. One of the big projects we've just won has come literally directly off recommendations from other people who have known our work on Dongtan from the sustainability and environmental point of view" (Alex, Arup Environmental Design Leader) D.3 "my planning team has positioned Arup in a way it's never been positioned in its whole history which is a great compliment…And I'm sure Dongtan has been a very big part of that positioning. With Arup on the frontline, because Arup in the past has always been behind architects and behind other front-runners in most of its projects, it doesn't tend to be the front lead contender. Whereas the way we're doing it is, so the Arup name comes first before anyone else's." (Head, Arup Planning Director)

Social-political approach surrounding the notion of a boundary infrastructure

1. Occupy a boundary bridging position

E.	Position the boundary infrastructure as a reference point	E.1 "So actually the London Climate Change Action Plan which was eventually launched on the 27th February last year which has had a big impact on the Clinton initiative which is now running with 40 cities was actually inspired by the Dongtan work. So, you know, that sort of explosive outreach is really quite formidable actually" (Head, Arup Planning Director, Arup) E.2 Arup always used the Dongtan project as the reference point when opening dialogue with external actors on the topic of eco-city development. i.e. "Dongtan as a model scheme has become synonymous with the very notion of the 'eco-city', representing China's commitment to sustainability to the world" (extract from the paper *An Interview with Peter Head of Arup, Architectural Design*, Special Issue: New Urban China, Castle,2008) E.3 "Head, who sits on the mayor's sustainable development commission, says: 'I remember Ken Livingstone talking about having seen the Dongtan project and how London had to get its act together.'" (extract from the article by Slavin in the *Guardian*, 28th June, 2006)

2. Mobilize social and political activities with non-field actors

F.	Form collaborative relationships with influential social and political actors	F.1 "British engineer Arup has agreed to help former US president Bill Clinton's charitable foundation advise 40 major cities around the world on tackling global warming." (extract from the report by Olivia Boyd, *Building*, 1st June, 2009)
G.	Hire people with social and political backgrounds	F.2 "Arup is getting this much more strategic approach that goes way beyond engineering, and now it has started to be a… or trying to be an influential player from a more policy perspective, governance perspective, with the muscle of these engineers and these architects and designers behind" (Poczebutaz, Senior Architect, Arup)
H.	Collaborate with industrial and academic institutes to help establish regulatory institutions and governing bodies	G.1 "Actually, Peter Head is the one who's actually starting to bring other people who are more policy based, well connected in different economic scenarios or international scenarios ... I don't expect Atkins to be doing

			that. I don't expect Buro Happlo to be doing that" (Luque, Senior Architect, Arup)
		H.1	"Arup, HSBC and Sustainable Development Capital identified the need for a research facility to capture and disseminate learning on sustainability and to attract environmental technology businesses" (extract from the report on the official website *Thames Gateway Institute for Sustainability*)
		H.2	"Arup and EPSRC have already pursued collaboration opportunities for UK academics and Chinese researchers arising from Arup's Dongtan eco-city project in China" (extract from the report on 'EPSRC and Arup join forces on design & engineering for the built environment' on the official website *Engineering and Physical Research Science Council*, 20th December, 2007)
3. Project an institutional arrangement			
I.	Raise a global agenda for sustainable urban development	I.1	"it's about strategic thinking to change and influence open environments at a global scale, global level … I'm talking about issues such as when Arup now hires the former climate change adviser of Ken Livingstone to think about policy issues as well as strategy issues … to actually liaise with mayors of 40 cities in the world to actually figure out how they were going to implement sustainability targets and reduce their carbon emissions." (Luque, Senior Architect, Arup)
		I.2	"it's actually selling the agenda at a global scale. So while maybe four years ago they were thinking about Dongtan…now the guys are setting the global agenda for the future of cities in the world." (Poczebutaz, Senior Architect, Arup)
		I.3	"he is still positive about the Chinese eco-town market, in spite of the failure of Dongtan. Arup has studiously avoided commenting on Dongtan's future, but Dilley now admits it is unlikely to go ahead. 'Officially it's still going to happen but I'm not very clear it is. But there are other spin-off projects from it. Sooner or later one of these will be built properly and it will show the world the future.'" (extract from the article interviewing Arup's new CEO, *Building*, 26th June, 2009)

Table 4.1 – Dimensions, Themes, Categories, and Data

4.4 Research Setting and Case Study

In this section, we firstly review the historical origins of city planning field which provided perspectives on the understanding of the emerging field of eco-city planning. We then study the case to understand what practices in planning profession have been revamped as a consequence of Arup's entrepreneurial actions.

4.4.1 Research Setting – Historic Origins of City Planning Practice

It was not until almost one hundred years ago that an organised profession of city planning came into existence (Ellis 2007). The profession of city planning at early days was arranged to respond to increasing urbanization as a result of rapid industrialization in the late nineteenth century. At the time, sustainability started to appear in the agenda of city planning to remedy the ills of industrial cities. Urban planners favoured an expansive swath of public park space in cities to illustrate their sustainability idea of city development, thus, visionary urban thinking dominated planners' design proposals during this period.

From the end of World War II to mid-1970s, planning profession underwent a paradigm shift in response to new urbanization trends in 'de-urbanization' and dramatic social and cultural changes. Technological innovations accelerated urban change in both physical urban forms and social and cultural concerns. Existing practices of planning profession became narrow and insufficient and the dominant visionary planning approach was juxtaposed with a controlled and monitored process taking social and political considerations into account. At this stage, rational considerations of urban systems for the purpose of achieving multi-objectives dominated the rules of planning practices over unrestrained ideas emphasizing visual effect.

The advocated rationalized process inadvertently led to specialization and fragmentation of the planning profession. Planners were trained to become disciplinary specialists and cities were planned according to the needs of its specific parts, which led to numerous undesirable results (Thornley and Newman 1996, Yeh and Wu 1999, Newman and Thornley 2002).

From the late 1970s to mid-1990s, global planning systems moved towards an even more rationale-based mode of city planning with limited room for visionary proposal due to the increasing pressure from rapid urbanization, turbulent global markets and rising

environmental problems (Ellis 2007). The overall goal of city planning was regularly intervened by the purpose of protecting widely shared public concerns in environmental and social aspects (Hall 2002). The term 'eco-city' for the first time appeared in Richard Register's milestone book Ecocity Berkeley (1987): Building Cities for a Healthy Future. The book offered a new perspective that eco-city development would provide a radically new urban form to adapt to the impact of climate change.

The concept of eco-city development gradually became one of the major possibilities of processing urban sustainability in a wider context after mid 1990s (White 2002). However, developing eco-cities posed serious challenges to city planners and triggered another paradigm shift in terms of both the concepts and practices of city planning. As a legacy of advocating rationalized and scientific procedures after World War II, city planners had been trained to be transportation planners, land use planners, and other specialized disciplinary professionals. However, the emerging eco-city development concept required planners to arrange the city as a system of interconnected parts supported by sound technical evidences. Planners found it particularly difficult to satisfy the criteria based on the existing system with disparate knowledge and skills distributed among a wide range of disciplines. Therefore, the emergence of the eco-city concept challenged planning profession to reconsider their roles in a wide context of sustainable urban development at multiple levels. Moreover, the challenges appeared more significant when only theoretical implications rather than pragmatic solutions existed in the field due to significant shortage in real demonstrations (Abbott 1988). (Appendix I at the back of the thesis details the review of the natural history of planning profession).

4.4.2 Case Study – Novel Planning Practices for Dongtan Eco-city Development

In the past decade, plans for eco-cities proliferated across the world with proposals in the UK and the rest of Europe in the pipeline, and more than 20 was under planning across China alone. Approximate 80 eco-city initiatives were identified as happening or having developed across the world according to a global survey carried out in 2009 (Joss 2010). Sustainable urban development grew as part of a growing trend of environmental consciousness in both the developed and developing world. However, the first milestone for shaping the practices of eco-city development as a nascent field did not exist until the launch of Dongtan eco-city project in China in 2005[6].

In August 2005, Arup, an engineering and business consultancy well known in the built environment, was commissioned by Shanghai Industrial Investment Cooperation (SIIC), a Chinese state-run pharmaceutical and real estate investment developer, to mastermind the first design phase of the Dongtan eco-city. SIIC envisioned the Dongtan Eco-city project as the first experiment to create a carbon-neutral city from scratch and a demonstrating prototype for the future of all cities in China. The Dongtan eco-city would be powered by renewable energy sources and as close to being carbon-neutral so as to achieve ambitious goals to deliver long term ecological sustainability as well as economic vitality and prosperity. Arup produced a masterplan for the Dongtan eco-city supported by multi-disciplinary resources across its global offices. The masterplan was based on a holistic planning approach which innovatively interlinked the design input from "urban design, sustainable energy management, waste management, renewable energy process implementation, economic and business planning, sustainable building design, architecture, infrastructure and planning of communities and social structures"[7]. The planning content included a transport hub and port which would

6 The world's first eco-city – Dongtan, http://en.wikipedia.org/wiki/Dongtan

7 Green Progress, "Arup and SIIC sign accord to develop further sustainable cities in China," Nov. 9, 2005,

accommodate fast ferries from the mainland and the new Shanghai airport, a leisure facility, an education complex, space for high-tech industry and housing etc. Zero carbon emissions were designed to be generated and average energy demands were planned to be cut by two thirds via a unique city layout, energy infrastructure and building design. By 2020, nearly 80,000 people were planned to inhabit the city's environmentally sustainable neighbourhoods and half a million by 2050. The development scale firstly targeted 630 hectares, roughly three times the size of the City of London.

The past planning history suggests the idea of building sustainable cities was not new in itself, but Arup's planning solutions to the Dongtan project were revolutionary in that it was the first time that so many new ideas of applying sustainability to urban cities were practically integrated into one single city plan. The novel holistic solution package evidenced that Arup made significant changes to the existing planning practices and created novel planning practices with the support of a new resource management system and ICT tools. Arup made changes on the traditional planning practices in the following three aspects.

Firstly Arup's novel approach changed the role of planners in urban development projects. Beforehand, urban planners were responsible for formulating a long-term vision, proposing plans for land use and infrastructure, and producing a collection of detailed plans to describe a wide array of considerations such as residential, recreational and commercial issues. Architectural/urban design was considered to be the fundamental basis for the whole planning practice so that technical strategies come in and follow the basis at a later stage. The decisions and assumptions urban planners made were largely based on existing industrial regulations and standards. In the Dongtan eco-city project, planners amalgamated macro planning with technical strategies simultaneously in order to generate optimum output of an urban design product with sound technical solutions. Instead of emphasizing planning as the focal point to

http://www.greenprogress.com/green_building_article.php?id=579.

sum technical parts together, Arup's holistic planning solution lay in a comprehensive end-to-end flat system which could simultaneously align sustainability criteria with every single technical disciplinary input. In particular, the holistic planning solution did not locate any single discipline at the focal point but ensure effective and efficient communication across them. One of our interviewees actually reconsidered planners' role in sustainable urban planning by highlighting the emergent requirement for system integrators,

> *"Sustainability does need to be able to challenge the technical teams, and particularly multi-disciplinary teams, I actually think that there probably is a role for a discipline that is called integration … the integrator's role could be more about actually, you know, a dedicated service towards ensuring the communication across those things."*

Secondly, the process of urban planning varied from the past planning practices. Before the Dongtan project, planners mainly carried out a linear process of urban planning: clients firstly employ business consultancies to develop business plans for land use, and real estate consultants make estimates for land value and forecast the potential market return; then urban planners join to propose urban plans in accordance with the business-led framework; At last, a group of multi-disciplinary engineers assess feasibilities of the proposed master plans. Adopting a linear design process, urban planners simplify the planning problem to basic quantifiable issues and often ignore the whole sector of the 'sustainable pie' at the planning stage. However, such a linear planning process was not sufficient for the Dongtan project which requested a high level of sustainable outcome. Planning tasks became much more complex after the addition of a broad range of inter-related ideas contributing to the overall sustainability objective. Contrasting the past planning practices, Arup's master plan solution demanded the disciplines of business planning, real estate assessment, urban planning and engineering strategies to collaborate simultaneously from the very beginning. Specialists from diversified backgrounds (including urban planners) had to work closely with each other on the first day because the results of any technical solution would be the assumptions to others. In

the Dongtan project, the requirement of integrating the new sustainability component with more than twenty design disciplines out ran the capacities of the existing project management system in Arup. Success depended on bridging dramatically different disciplines at team, organisational, and regional levels to respond to any emerging need for the design. To adapt to such working culture 'get work progressed while figuring out the next work need', Arup created a novel design system, called 'integrated sustainable design methodology' to help organise team resources and monitor the planning process on the same baseline without compromising any disciplinary input. A new ICT tool 'Integrated Resource Model' (IRM) was established to optimize diversified information flows so that they could work coherently and simultaneously with no spatial element in the design model. The ICT tool IRM not only captured sustainable performances in various functions of the city development but also assisted Arup's resource management through informing and influencing key decision-making events. As such, the new design system supported by IRM enabled Arup to effectively coordinate various technical parameters of industrialization into a single design product while the project team was busy with managing cooperation with both internal and external parties. As suggested by a senior urban designer in Arup,

> *"...previously urban design would be commissioned on the basis of the urban design, and it would put their diagrams on the map. And the technical strategies will only come along way, way after that ... the urban design on the table first and then telling the technical strategies how to do. You now need to go and design around that ... in actual fact, it's probably an amalgamation of the two, which I think means that we need to try to keep the plate spinning a lot longer so that it kind of gravitates towards an optimal solution. I think the ultimate outcome has got to be ... the optimum density and height of development, the optimum mix of residential, commercial, industrial that means that people travel the least distance possible. But also, that with the distributed energy supplies, we're able to balance load with supply in an absolutely optimum way. However, at the moment, that's all being done, pretty much, through on the basis of people's experience with an urban design that's already been defined."*

The third novelty in Arup's solutions, likely to be the most crucial one, was that the new planning framework added social, economic and political design considerations in addition to technical strategies for sustainability. According to Arup, socio-economic, cultural and funding strategies were in the first time planned with other technical design such as transport, energy, water, IT, environmental, logistics, micro-climate, sustainability, and risk management strategies. Such a design framework, although being coherent with the past theoretical sustainable city concepts (see the review of historical origins of planning profession) and ultimate objectives of creating a liveable city, took a crucial step forward by putting the theory into practice. For example, several economic development models were engineered to provide options as to how much value developers would generate from various areas of the development activities, ie. asset management and green technologies; a cultural planning team was assembled at local Shanghai Arup office to understand the impact of social and culture history of Dongtan area on the masterplan. Contrasting with the previous understanding of sustainable development staying at a conceptual level, Arup demonstrated a pragmatic way to balance the interdependent and conflicted areas including environmental imperative, economic demands, socials needs and institutional interests.

To summarize, historical development of urban planning profession provided theoretical foundations for sustainable city development. Arup's integrated design practice for the Dongtan project was the first time in history that all those sustainable planning criteria were pencilled down from conceptions to drawing boards and industrial reports. Compared to the traditional planning process in which few chief architects/planners dominated, the novel integrated design methodology dissociated itself from the kind of egocentric and heroic individuals who were responsible for creating overall vision based on personal ideas. The new practice provided a sanity check to aid the decision making process including resource allocation as well as efficient disciplinary collaboration. As such, Arup signalled a symbolic

sustainable urban planning approach by claiming all the social, economic and environmental aspects of an eco-city would be carefully designed to achieve long-term sustainability.

4.5 Research Findings

According to the case study, Arup's novel integrated design practices for the Dongtan eco-city project revolutionised traditional planning practices. In this section, we unpack the understanding of our research question: how Arup as an elite organisation moved out of its embedded market base and established the Dongtan design solutions as the dominant planning practices during formative phases of a nascent eco-city field.

We find that Arup had strong incentives to claim the novel practice as a new legitimated category after the entrepreneurial organisation had successfully developed the novel practice signalling a departure from the dominant way of urban planning. To fulfil the intention, Arup conducted boundary work to intertwine its boundaries with the nascent eco-city planning field and demarcated the new field through the promotion of their novel practices. Our analysis unveils Arup adopted two strategic approaches to realise the boundary work: a market-focused approach to achieve a cognitively dominant position and a socio-political approach to ensure a wide range of field and non-field actors to abandon past planning practices in favour of the new ones that Arup was championing.

In light of ambiguities and uncertainties, the market-focused approach refers to the process that Arup intertwined its boundaries and the nascent field, influenced customers and stakeholders in a way of disclosing innovative practices, revealing information to demonstrate its organisational capabilities, and affecting public audiences' perception of the firm. As an outcome, the adoption of a market-focused approach facilitated Arup to become cognitive referent during the formative phase of the nascent field (Santos and Eisenhardt 2009) (For the

evidence that Arup was cognitively referenced within the nascent field, see Arup's media coverage analysis in Appendix 4.3).

In light of remaining weak regulative and normative framework within the emerging field, the socio-political approach refers to Arup's activities of engaging other field and non-field actors to co-institutionalise the novel design practices as legitimated standards for the sustainable planning field. We found that the organisation occupied a boundary bridging position to initiate the socio-political approach, mobilized support from a wide range of actors and projected a forward-thinking institutional framework.

More interestingly, we find an effective mechanism, Arup's strategic leverage of a system of boundary objects or a boundary infrastructure, underpins the both approaches. Before we unfold the details of how the mechanism facilitates the extended and complex process of adopting a market-focused and a socio-political approach respectively, we hereby address the conceptions of boundary objects in the existing organisational theory.

The concept of boundary objects was initially developed as an analytical framework to allow meaning transmission between very diverse groups of researchers in scientific work (Star and Griesemer 1989). Boundary implies edge or periphery which is used as a shared space (Star 2010). Objects have the characteristics of displaying intrinsic and symbolic dimensions (Zott and Huy 2007). Boundary objects can be in the form of "artefacts, documents, terms, concepts and other forms" that are shared or shareable to convey information across different contexts and mobilize symbolic actions (Star and Griesemer 1989, Carlile 2002, Zott and Huy 2007, Bechky 2011). Being "simultaneously concrete and abstract, specific and general, conventionalized and customized" (Star and Griesemer, 1989:408), boundary objects provide a shared context "sitting in the middle".

Scholars categorise boundary objects into different types to understand their distinctive nature. For example, Star and Griesemer (1989) propose four categories of boundary objects: *repositories*, such as parts libraries; *standard forms and methods*, such as problem solving methods; *objects or models*, such as sketches and drawings; and *map of boundaries*, such as process maps and workflow matrices. Benn and Martin (2010) converge them into *visionary boundary objects* – capable of evoking emotive responses from a range of people (Briers and Chua 2001) and *structural boundary objects* (Yakura 2002) – capable of coordinating work based on shared infrastructure around which groups organise.

In our case, we found Arup leveraged visionary and structural boundary objects in the Dongtan project to shape its novel practices as viable market solutions. We then discovered that Arup promoted, leveraged and manipulated the notion of the Dongtan project to socially and politically construct the new design practices in the context of nascent field. In this regard, the notion of the Dongtan project symbolically represents a system of boundary objects, or to become what scholars called '*boundary infrastructure'* (Bowker and Star 2000).

The plan of the remaining paper is as follows. We firstly present our findings on the activities of Arup's implementation of a market-focused approach and a socio-political approach to establish its new practices in the nascent eco-city planning field. We explicate how the strategic mechanism supported Arup's actions by understanding the relationship between actions and attributes of the boundary objects (infrastructure). We then discuss the broader implications of leveraging boundary objects after overviewing Arup's strategy implementation in the nascent field. We also imply some interesting findings by examining the sequences of Arup's activity implementation. Our suggestive discussion does not mean to be conclusive in this paper, but rather outlining an approach to provide analysis of the interesting case and trigger further discussion of established organisations' entrepreneurial actions to establish new practices in a nascent field setting.

Process	A Market-focused Approach	A Socio-political Approach
Strategic intention	Deliberate	Emergent
Goal	Demarcate novel practices as viable market solutions organisation	Establish social and political justifications surrounding novel practices
Activities	• Craft a vision • Disseminate stories • Signal leadership	• Occupy a boundary bridging position • Mobilize social and political non-field actors • Project an institutional arrangement
Rationales for taking actions	• Lack of established market solutions	• Lack of formal networks, industry regulations and standards
Mechanisms underpinning each set of activities	• Promote visionary boundary objects to envision novel practices • Leverage structural boundary objects to engage market actors • Combine visionary and structural boundary objects to demonstrate exemplary distinctiveness	• Position the boundary infrastructure as a reference point • Encourage emergent responses and debates surrounding the boundary infrastructure • Project a future institutional framework based on the early version of the boundary infrastructure
Rationales for leveraging boundary objects (infrastructure)	• Intrinsic and symbolic dimensions of boundary objects – people make inferences on the basis of shared interpretations	• Interpretive flexibility of boundary objects – various groups make communication on the basis of different interpretations
Scope conditions: High ambiguity environment (e.g. nascent fields)		

Table 4.2 – A Framework for Establishing New Practices in Emerging Fields

4.5.1 Adopt a Market-focused Approach via Leveraging Boundary Objects

Before the novel practice was fully marketed, no one knew whether it would be successful or not. After developing the novel solutions for the Dongtan project, the first challenge for Arup was to demarcate its solutions across its organisational boundaries in the nascent eco-city planning market. Organisational boundaries are considered as the demarcation between organisations and its environment (Santos and Eisenhardt 2005). Past studies have showed that communication across organisational boundaries is hard given the problematic nature of knowledge (Molotch and Logan 1987) being localized (limited knowing), embedded (tacit knowing) and invested (costly knowing) in practice (Ferrier, Smith et al. 1999). Similarly, Arup were aware of the difficulty of making the in-house specialized practices into an understandable and justifiable public notion. Arup also find it difficult to get any existing successful evidence that the new solutions would pay off because it was for the first time in history that the new practices revolutionised the traditional planning practices and the Dongtan project was the first eco-city project in the world at that time. Thus, senior managers spent considerable time trying to grapple with questions such as: In which way could we present that the novel planning practices would be successful? Why we are the firm being capable of delivering it?

In response, Arup took actions to demonstrate new practices as viable market solutions such as envisioning the technical robustness and enhancing the influential sphere of the solutions. Interestingly, a number of interviewees suggested the way how Arup leveraged their involvement in the Dongtan project was unusual. They perceived that Arup proactively leveraged the notion of the Dongtan project to offer the promise of effective communication across their organisational boundaries, to disseminate innovative design stories embedded in the novel practices, and to open up a shared context for further development of the design practices.

"Dongtan's being probably one of the most amazing marketing bits for Arup that they ever could have hoped for. One of the big projects we've just won has come literally directly off recommendations from other people who have known our work on Dongtan from the sustainability and environmental point of view"

- *An environmental team leader in Arup*

Evidenced by multiple interview quotations (Table 4.1), we interpret Arup undertook three sets of activities: craft a vision, disseminate stories and signal leadership to demarcate the new practices as market solutions, similar to the framework proposed by Santos and Eisenhardt (2009) on strategic actions by which successful organisations undertake to claim a nascent field and achieve cognitive dominance. Within each set of activities, we explicate how the organisation leveraged a system of boundary objects such as visionary and structural boundary objects to provide a means of "transforming knowledge and changing practices across occupational and professional boundaries" (Oswick and Robertson, 2009:180) (See Table 4.1).

Craft a vision – envisioning novel market solutions

Organisations often use analogies to help legitimize their vision (Hargadon and Douglas 2001). Arup firstly promoted the novel market solutions as a market template by crafting visions of Dongtan eco-city development that other actors were inclined to endorse. Before the birth of Dongtan eco-city project, there was no practical demonstration for developing an ecological urban area at a city scale. Although a collection of ideas and propositions of eco-city planning have been addressed in the history of urban development, the term 'eco-city' remained at a conceptual level.

Arup envisioned their eco-city solutions with a planning template which broke with the taken-for-granted planning practices dominated in the past. The organisation used 2D/3D visual diagrams of proposed masterplan and broadcasted project-related figures to translate abstract concepts into real-life meaning. Presented in a familiar and understandable way to field

audiences, the visionary boundary object serviced as a reference point conveying idiosyncratic knowledge in a common language. Moreover, the objects became the visionary embodiment of Arup's novel market solutions which evoked emotive responses from different market actors. Herbert Girardet, a cultural anthropologist who devised the theory of ecological footprint, told Guardian in 2006 that *"with Dongtan, a sustainable future is not some distant dream, but a vision that is actually being realised"*. Apart from the visualized diagrams, Arup also used quantified figures to visualise the promoted market template. For example, Arup supplied the planning content to one of the media reports on FT.com in September 2005, *"by the 2010 World Expo in Shanghai the developers hope 25,000 people will be living there, rising to 80,000 by 2020. Eventually the eco-city could have a population of 500,000"*. In this regard, articulating the eco-city vision through visionary boundary objects, Arup embodied the Dongtan project as a practical eco-city model, making contrast to any existing sustainable planning proposals which only stayed in theoretical paperwork.

Disseminate stories – engaging market actors to endorse the vision

Secondly Arup disseminated stories of novel market solutions to promote its newly promoted vision. Structural boundary objects including planning process maps, ICT software interfaces, and workflow matrices were used to provide compelling reasons to justify their novel market solutions.

The structural boundary objects translated Arup's propositional and theoretical design concepts and methods into forms of practical stories (Benn and Martin 2010). For example, using planning process maps can help explain what functional disciplines were integrated to deliver the novel market solutions and how each change made in one system would ripple across the whole design solution. Rendering stories through the rationalized examples such as process maps, Arup made the promoted market solutions technically attractive to a diverse group of potential adopters.

Arup also benefited from engaging a wide range of market actors to endorse the crafted vision by leveraging the intrinsic value reflected in the structural boundary objects. One of the examples was the inherent 'negotiated urbanism' design concept embedded in a structural boundary object – an ICT tool called Integrated Resource Model (IRM). In contrast to the conventional planning approach, the idea of 'negotiated urbanism' rejected the kind of egocentric individuals who overarch great vision of ideas. IRM established a platform that prevents single or few individual(s) from instructing others to execute ideas but rather engage actors to participate in a creative planning process together. The ICT tool precisely illustrated the effects of any proposed change on the outcome of 'negotiated urbanism'. In that sense, the structural boundary object facilitated a boundary process where market actors could jointly learn and transform the process of delivering sustainable urban planning. Arup could then benefit from any participant's concerns towards the IRM to make relevant modifications.

Several interviewees mentioned such a market-focused approach relying on attracting market participants was the result of Arup's 'half feeding' strategy implementation.

> *"during that two years you get out there and you talk about it, you feed the market half of the information, and what happens is other people come to you talking, oh what did you do there, I did this on this project and that happened, well then, and what you're finding is they're bringing further bits to the jigsaw which they don't realise they've got because they're in isolation, and you're gathering more. So that come two years' time half that information has got on to the market and you've built another half."*

In short, the 'half feeding' strategy was implemented by relying on the attributes of a structural boundary object – tangible physical objects provide a structured space where the interpretation of embedded knowledge allows flexibility (Yakura 2002). In contrast to a one-off product launch in a market, the structural boundary objects provided a reference point for analysing and adoption of novel market solutions while also welcomed interpretive flexibility from any interested party. Therefore, Arup's effective leverage of structural boundary objects

to disseminate stories facilitates a shared and tangible form of conversation across boundaries as well as leaving the space for learning and transforming the novel knowledge.

Signal leadership – demonstrating exemplary distinctiveness

Known as an established engineering consulting firm, Arup rarely enjoyed strong influence in the field of urban planning before the Dongtan project. The project provided an unprecedented opportunity for Arup to re-establish itself and brand the organisation with an 'eco-city badge'. According to our interview transcriptions, the activities of the Dongtan project also offered Arup opportunities to signal its leadership edging over its competitors (See Table 4.1).

Firstly Arup signalled its leadership by achieving significant media coverage about their involvement and resulted novel market solutions. Such market actions were particularly effective because patterns of media coverage reflect and affect the process of reputation accumulation for firms competing in emerging markets (Rindova, Petkova et al. 2007). Arup worked with media publishers to illustrate a blueprint that the planning solutions for the Dongtan project was a revolutionary attempt in creating an ecological city from scratch and a prototype inspiring other environmentally distressed cities in China and the world. In particular, Arup approached the public media with of the demonstration of exemplary visionary and structural boundary objects, such as making IRM open to public, presenting the novel planning methodology, publishing academic papers, promoting eco-credentials in global workshops and conferences, and welcoming media to carry out interviews with Arup's senior managers. As a result, the firm successfully created self-serving illusions of the Dongtan eco-city project and its attached design solutions. Even the managing director of Arup was surprised at the extraordinary amount of media hype that the Dongtan project had created. Also, a US media publisher doubted American mode of achieving sustainability after learning about Arup's eco-credentials,

> *"In listening to him describe the dire changes that are happening to the world, I couldn't help but think that maybe our preservation mantra of 'the greenest building is the one that's already been built' was just maybe a bit naïve in terms of the impact it can ultimately have when the creation of new megacities could potentially so outstrip all of our current cities."*

Secondly Arup signalled their leadership through justifying their distinctive competitive advantage over traditional architectural or planning firms. While the extraordinary media coverage demarcated the novel market solutions, it also revealed information about Arup's strategies and capabilities, which thereby influenced field actors' perceptions of the firm. Through the public promotion of both visionary and structural boundary objects, Arup concretely narrated understandable stories on 'why and how Arup were capable of delivering the novel market solutions'. The firm's R&D director declared the Dongtan project being the "*ultimate demonstration which required and merged different packages that Arup were capable of"*. He explained why Arup had the competitive advantages edging over those specialized planning firms by indicating the novel market solutions were based on sheer depth of planning, engineering, economics, and political resources which the competitors lacked (See Table 4.3 for the comparison between Arup and its competitors). Arup's managing director also gave an example of energy strategy proposal in the Dongtan project,

> *"it's really all the large British consultants… I've had 30 different disciplines working on an energy strategy. Now, you know, not many firms can actually field 30 different disciplines, can they? So it limits it to the big boys, and that limits it to the big boys that want to think outside the box as competitors, but a lot of people try and fail."*

	Arup Novel Sustainable Urban Planning Practice	**Competitors' Urban Planning Practice**
Design Philosophy	Design (Holistic thinking) driven	Vision (Architecture) Driven
Design Approach	Spatial analysis and visual approach; start with holistic	Start with a big idea and then realise the idea by engineering

	conceptual thinking of the project	solutions
Project Team Formation	Integrated design teams within the firm	Alliance with external engineering consultancies
Strengths	Capable of providing a holistic solution package	Have the option to choose the best suitable consultancies to work with
Weakness	May have relatively weak disciplines in the whole integrated project teams	Less likely to provide an integrated solution package

Table 4.3 – Exemplary Distinctiveness from Market Competitors

Summing the above, by combining visionary and structural boundary objects to claim exemplary capabilities, Arup temporarily edged over its competitors and signalled itself as a leading firm within the nascent field.

4.5.2 Adopt a Socio-political Approach via Leveraging a Boundary Infrastructure

Although the market-focused approach helped establish Arup's new practices as viable market solutions, ambiguities surrounding the legitimacy of the solutions remained in the rapidly evolving eco-city planning field. This was because the success of an eco-city development depends on not only the quantifiable reduction in carbon footprint, but also the satisfaction of a variety of interests including:

1) Economic and financial viability of the project
2) Cultural considerations and arrangements
3) Public acceptance and community needs
4) Availability of a suitable regulatory and administrative framework

Apparently none of the above concerns could be easily resolved, and integrating the considerations of socio-cultural needs with economic and political systems points to a long-term transition process. Social and economic interests were concerned to be transformed into political benefits in China, thus, the design framework for eco-city development was heavily influenced by the dynamics of social and political settlement. In particular, the conflicts among disparate stakeholders' interests were proven problematic and challenging. Some

stakeholders involved in the project were in pursuit of GDP growth and short-term benefits, ignoring or placing less focus on long-term benefits; some were concerned about their own political status and promotion possibilities; some others were mainly incentivised by economic earnings and profitability. The decisions and priorities made by different stakeholders and other third parties including local communities and institutes all had effect on the outcome of eco-city planning. As such, the demand for planning a sustainable city inevitably required Arup to cooperate with a wide range of field and non-field actors to legitimate its novel practices, especially with those who would provide important social and political capital into the legitimation process.

In response, Arup's carried out another stream of actions – taking a socio-political approach to mobilise collective agencies to co-institutionalise the new design practices. The approach aimed to gain new value in culture norms and public acceptance, and achieve normative and regulative justifications for the newly demarcated market solutions (DiMaggio 1988, Fligstein 1997, Greenwood, Suddaby et al. 2002). To facilitate the approach, Arup leveraged field and non-field actors' interpretation of the Dongtan project's merit as well as demerit in its favour. In this regard, the notion of the Dongtan project was conceptually leveraged as a symbolic boundary infrastructure subject to interpretive flexibility (Star 2010).

Our analysis suggests that the organisation's socio-political effort can be categorised into three sets of activities: occupy a boundary bridging position, mobilise support from a wide range of actors, and project a forward-thinking institutional framework (See Figure 4.1 and Table 4.1). Different to the market-focused approach highlighting technical merits embodied by the boundary objects, Arup's socio-political approach relied on the interpretive flexibility of a boundary infrastructure to carry out the above activities.

Occupy a boundary bridging position

After the novel market solutions became cognitively referential practice in the nascent field, Arup was aware the lack of institutionalized norms and rules still resulted in the absence of stable relationships (Peng, 2003), structured domains (Hardy, 1994) and settled conflicts of interests (Bartley, 2007). Such field-level characteristics have been generalized as enabling conditions for institutional entrepreneurship (Fligstein, 1997, Maguire et al., 2004; Lawrence and Pillips, 2004), however, organisations operating in nascent fields often struggle to find an effective basis to start with their institutional activities.

Arup firstly occupied a boundary bridging position which facilitated the organisation to have the access to a diverse group of field and non-field actors. Such a boundary bridging role is strategically important for any organisation operating in nascent fields where no established network exists and actors holds disparate positions (Burt 1997, Maguire, Hardy et al. 2004). For Arup, being able to bridge distributed resources across disparate actors was benefitted from its effective leverage of the notion of the Dongtan project as a boundary infrastructure. Instead of emphasizing the effect of representation and specification in the market-focused approach, Arup made use of the interpretive flexibility of a boundary infrastructure to encourage individuals to jointly transform their knowledge on the same platform (Spee and Jarzabkowski 2009). The boundary infrastructure provided an embodiment of new practices to which different actors could express their emergent responses and alternative ideas. As an outcome, Arup positioned itself as a reference point to access considerable amount of unstructured and distributed resources, and benefitted from a 'negotiation' process of which different domain-specific actors could address the consequences, differences and dependencies of the novel market solutions. Meanwhile, the occupation of a boundary bridging position also provided Arup an instrument to get on the steps of consequent socio-political processes such as transiting societal systems and altering regimes of governance and

nested hierarchies to "capture gradual maturity and specification of an emerging institutional framework" (Greenwood, Suddaby et al. 2002).

Mobilize social and political activities with non-field actors

Following the occupation of a boundary bridging position, Arup mobilised field and non-field actors to participate in the 'negotiations' surrounding the notion of the boundary infrastructure – the Dongtan project. The inherent properties of the boundary infrastructure established a shared syntax within which Arup's novel design practices were constantly under review and its affiliated market solutions were subject to interpretations. As a result, the new design framework became so familiar to actors from diverse groups and communities that Arup was able to establish a working relationship around or as an extension from the intrinsic value of the Dongtan project. In this regard, the boundary infrastructure provided communication channel that enabled Arup to 1) form alliance with influential field and non-field actors, 2) recruit social and policy specialists to forge inter-actor ties, and 3) collaborate with academic institutes to help establish regulatory institutions and governing bodies.

Firstly, our media article database indicates Arup formed strong collaborative relationships with global influential political actors to secure support for the emerging eco-city field. For example, The Times reported that the former London mayor Ken Livingston made the decision of regenerating London east end gaswork area after he visited Dongtan and Arup's office in China. Arup was then invited by the mayor to sit on sustainable development commission. As an influential politician and global leader on sustainability in cities, Mr. Livingstone assembled a strong coalition of twenty cities across the world to collectively combat climate change in 2005. Meanwhile, Mr. Livingstone also announced his strategic planning document the London Plan to develop a 1,000-home zero-carbon community in Thames Gateway area. The successful promotion of Arup's novel planning framework earned the organisation an opportunity to work with the mayor to mastermind the London Plan. In

June 2009, Arup signed a memorandum of understanding (MOU) with C40 Clinton Climate Initiative, a group of mayors of the world's 40 largest cities to enhance their dominant influences. In the scheme Arup agreed to help former US president Bill Clinton's charitable foundation to advise major cities all over the world on tackling global warming. It was Arup's sustainable planning expertise developed from the Dongtan project that would benefit the C40 cities in reducing greenhouse gas emissions, according to David Miller, mayor of Toronto and chair of the C40. Some other examples include the signing of the MOU between Arup and the Administrative Committee of China's Wuhan Economic & Technology Development Zone (WEDZ) for masterplanning a 'Demonstration Industrial Park for Energy Saving and Environmental Protection' in February 2009 and the involvement in the Mayors Summit 2009 which brought around 60 mayors from the world's largest cities together to discuss low carbon revolution in cities.

Secondly, the symbolic effect of the boundary infrastructure enabled Arup to attract and recruit people with social and political background. The recruitment enhanced Arup's connections in various economic and international scenarios. A senior architect highlighted such movement was unusual for an engineering-based firm and unique compared to the firm's major competitors in the field,

> *"what I'm saying is that they are getting in at director level, which is really cool, because there are like between 40 and 50 people who already have some type of experience with mayors; a lot of like international exposure and they're getting associate director and director level, so… I've met some interesting people recently here in Arup. We're hiring these people? I don't expect Atkins to be doing that. I don't expect Buro Happold to be doing that."*

Lastly the organisation created an enduring coalition with a number of prestigious academic institutes as an extended effect from the boundary infrastructure. Collaboration with well-known universities and research institutes has considerable impact in China since academic institutes are traditionally perceived as the symbols of trust and high social status in the Far

East country. As an extended direct outcome of delivering the Dongtan project, Arup co-established Institute for Sustainability (IoS) branches in both London and Shanghai with Thames Gateway and Tongji University. The Institute for Sustainability was created to promote collaborative research on Sustainable Design and Construction of the Urban Development. The MOU signed by the three parties formalized the shared intent of UK and China to become leaders of the environmental technology industry. Meanwhile, Arup signed contract with Engineering and Physical Sciences Research Council (EPSRC) in UK to provide support on research and formed Eco-city research networks including Imperial College, UCL, and Southampton University in UK and Tongji University in China. Additionally, Arup sponsored and won numerous industrial awards in sustainable urban planning. For instance, Arup and Bond University were jointly awarded for the 'Sustainability in the Built Environment' at the 2009 EPA Sustainable Industries Awards in Australia. Three months later, the organisation won 'Cities of the Future' final competition in Finland. Among the five finalists in the competition, Arup dominated by occupying three of them including Arup London, Arup New York and Arup Foresight Innovation.

Overall, Arup effectively leveraged the inherent value of the boundary infrastructure and forged multiple ties with a network of influential social, political and academic actors. During this process, Arup were involved in the dynamics of normalising, fixing and stabilising the meaning of the novel market solutions, hence influencing the development of the nascent eco-city field. The deep embedment in social and political relationships reinforced the centrality of the organisation especially when the institutional framework for the nascent field appeared vulnerable and embryonic and the trust among field actors was not stabilized. In this regard, the interpretive scope and flexibility of the boundary infrastructure accelerated the collective contribution to the transformation of industrial systems and market solutions (including not just design solutions but other related business models), which we conceive being different

from the dynamics in mature fields where institutionalized practices and field-level norms exist.

Project an institutional arrangement

Arup's novel design practices created in the Dongtan project (the boundary infrastructure) successfully inspired a huge wave of international debate on the practices of eco-city development and this alone was already an accomplishment. The new design practices redefined how a wide range of actors including commercial firms, government, society communities, and NGOs should play their roles in a new technical, social and political system. However, such grand-scale ambitions in adjusting and integrating many things at once also suffered from drawbacks such as non-collaborative actions. The nature of interpretive flexibility of the boundary infrastructure not only encouraged the communication across barriers, mobilised a wide range of actors to work together, but also attracted participants to express their different voices. In other word, the rapid evolution of the emerging eco-city field and Arup's newly promoted design practices had raised as many questions as the solutions which the practices were originally created to resolve.

In 2008, the Dongtan project overloaded with breath-taking ambitions announced the project suffered from exceeding delay and fell short of implementation. Much of the media coverage suggested the project delay was mainly due to a political scandal event in China. On one hand, the unsuccessful grand-scale outcome became a setback for Arup to approach their external environment, but on the other, the project delay reinforced Arup's claimed planning philosophy for any sustainable professional planner would encounter – unsettled social and political struggles before shaping urban processes.

Interestingly, we found Arup did not reduce the frequency of their socio-political activities after the unforeseen negative consequence in relation to their promoted boundary infrastructure. Instead of directly visualising and promoting the notion of the Dongtan project,

Arup continued engaging collective effort to reflect their design philosophy based on the inherent properties of the boundary infrastructure. More specifically, Arup manipulated the negative responses as an opportunity for raising the level of design standards within the nascent field. The organisation emphasised any eco-city development should not just stop at the creation of urban forms, but actually needed to establish a robust planning system taking extended impacts of social conditions, economic patterns, and political support into account.

Where possible, Arup demonstrated its ambition in creating an institutional environment for the nascent field and projected its forward-thinking institutional framework. For example, the Dongtan project director illustrated Arup's projected future for human development by publishing an 83 page report 'entering the ecological age: the engineers' role' with Institutes of Civil Engineering in UK. The report went beyond the eco-city development field and discussed other alternative ways towards sustainability, i.e. retrofitting and refurbishing existing urban infrastructures. Written in other five languages, the report generated significant interests from field and non-field actors and was presented in a series of Brunel lectures in the build environment industry. Arup was also involved in the debate such as 'future of cities' when collaborating with non-profits, foundations, and think tanks. Their partnership with Columbia University and Tsinghua University in the Urban China Initiative led to the development of the Urban Sustainability Index (USI), a new tool for evaluating how cities in developing countries are balancing growth and sustainability. Although the quantitative USI has been referred as a new sustainable planning framework since 2010, the philosophy of the new framework was deeply rooted in the original notion of the boundary infrastructure that Arup created. A senior architect in Arup realised the organisation were trying to set the agenda for the global world,

> *"it's actually selling the agenda at a global scale. So while maybe four years ago they were thinking about Dongtan…now the guys are setting the global agenda for the future of cities in the world."*

Similarly, an urban design group director suggested that Arup were projecting an institutional arrangement after having been through two generations of organisational development including providing component services to a single system (e.g. buildings and bridges) and offering services to more complex systems (e.g. mega infrastructure systems). From his view, the third generation of Arup aimed to match with the future of the institutional framework,

> *"I think the third generation is actually kind of ecological place making. It's not the eco-cities; it's the mindset. It's the systems; it's the systems response to climate change and impacts."*

Summing the above, Arup undertook an entrepreneurial stance on the institutional framework in order to remain at top of the evolutionary process of field emergence. Regarded as an extended notion of the original boundary infrastructure, the forward-thinking institutional framework enabled the organisation to continue attracting attention, capital and resources for their purpose of improving their innovative design practices and achieving a dominant position in the field. The improvement reflected in between the future institutional framework and the original design practices in the Dongtan project also indicated a rapid cycle of innovation and institutionalization process in a nascent field (Greenwood, Suddaby et al. 2002).

4.6 Discussion

This study suggests that organisations adopt a market-focused approach to demarcate novel sustainable design practices and a socio-political approach to negotiate, settle and allow flexibility to evolve in the patterns surrounding the solutions. On the one hand, the market-based approach emphasises economic rationality and the technical merits of novel practices as well as competitive capabilities of entrepreneurial organisations. On the other hand, the socio-political approach focuses on coalitions with various influential actors to become involved in

the social and political construction of novel practices and market institutions. The benefits from both approaches should be acknowledged and the two approaches are actually blended together and sequenced over time. We found that the market-focused approach *deliberately* disrupts a market through the introduction of a new product, service or technology and practice. At other points in time, the socio-political approach helps to equilibrate the *emergent* turbulence initiated by market-focused intentions and opens up the possibility of 'strategic learning' (Mintzberg and McHugh 1985, Mintzberg and Waters 2006). In this section, we compare how the two approaches were implemented by closely basing it on and round the notion of a boundary infrastructure, and then discuss the implications for theory building.

4.6.1 Combination of 'Deliberate' and 'Emergent' Strategies

In the analysis section, a 'boundary process' shows that organisations leverage a boundary infrastructure and its contained boundary objects to support their entrepreneurial actions so as to establish novel practices in nascent fields (Ferrier, Smith et al. 1999). The repository character of a boundary infrastructure enables organisations to index novel practices into a tangible and understandable prototype, emphasise the soundness of its new practices across the given boundary of the nascent field, and simplify and distil the properties and outcome of the novel practices to achieve wide recognition. In the Dongtan case, although Arup *deliberately* made persuasive arguments by promoting new design practices as viable market solutions, the organisation was also aware of the danger of getting locked into stable fantasy solutions without further adjustment. Consequently the organisation made use of the interpretive flexibility of the boundary infrastructure to alter what constitutes best market solutions through mobilising, influencing and shaping social and political perceptions. Such strategic actions, quoted as 'half feeding' strategies by interviewees, on the one hand, can lock a number of field and non-field actors into an enduring coalition with the organisation,

and on the other hand, prepare the organisation to be open, flexible and responsive to the contingent nature of an evolving field.

We conceive Arup's implementation was guided by a mixed 'deliberate' (mainly market-focused approach) and 'emergent' (mainly socio-political approach) strategy which constitutes a distinctive conceptual framework for field activities in nascent fields. Conducting entrepreneurial actions in mature fields is normally purposive and obvious because the field belief systems and industrial structures and relationships are established and stabilized (Fligstein 2001). In emerging fields, framing and justifications of processes for novel market are less predictable and linear. Organisations are more likely to confront unintended as well as intended consequences (i.e. negative responses towards the demarcated boundary infrastructure), which may depart from their initial intentions. The adoption of a mixed 'deliberately emergent' strategy is especially effective in nascent fields considering their associated contingent and emergent natures. Furthermore, the multi-faceted nature of boundary infrastructures appears to embody the 'differing degree of deliberateness and emergentness' (Mintzberg and Waters, 1985: 258) so that organisations can *deliberately* justify novel practices as cognitive market solutions and *flexibly* pull themselves away from a solution 'lock-in' trap by encouraging communication and debate. Consequently, organisations are facilitated through boundary infrastructure to intentionally develop field conditions that will promote their subsequent strategic intentions so they can emerge incrementally (i.e. engaging a variety of field and non-field actors for collective effort in this case). Utilising the strengths of a boundary infrastructure to increase network externalities, organisations are more likely to overcome 'incumbent inertia' and strengthen the vulnerability against the solution 'lock-in' effect (Srinivasan, Lilien et al. 2004). In other word, implementing a 'deliberately emergent' strategy benefits organisations by developing themselves organically around the edge of a boundary infrastructure – an effective way of

entering nascent fields to achieve first-mover advantage and monitoring the opportunities of sustaining the competitive advantages surrounding the newly created field's vision as well as enhanced organisational influences.

4.6.2 Sequence of Individual and Collective Actions

In the existing literature organisations' entrepreneurial actions in institutional fields can also be categorised into two themes. One theme focuses on how organisations *individually* manage their own firms (Rindova and Kotha, 2001, Hargadon and Douglas, 2001) to shape their actions in emerging fields. For example, Aldrich and Fiol (1994) observed organisations *individually* encompassing symbolic language and behaviours to establish their distinctive identities in the formative phases of new fields. How new inter-actor relations are forged by organisations to bring *collective* actions to novel legitimate practices is the second theme (Leblebici, Salancik et al. 1991). Studies on collective actions hold the account that institutions are "cooperation-for-collective-benefits" (Knight 1992) and field changes reflect a political process of balancing power and interests among collective actors (Fligstein 1997, Seo and Creed 2002). As such, a single venture's distinctiveness has to be counterbalanced with *collective* efforts from various field players so that the new activity can be portrayed as familiar, trustworthy and scalable. C*ollective* actions are used to develop new institutional infrastructures that set, for the emerging fields, enforceable standards and rationalized systems.

Consequently, the longitudinal sequence of undertaking individual and collective actions warrants further investigation. Navis and Glynn (2011) found in the early stages of market emergence, entrepreneurial organisations put emphasis on "shared sameness with other category members", to create a *collective* identity for the purpose of stabilising and legitimating the meaning of a new market category. In turn, after the market category has achieved taken-for-grantedness, Navis and Glynn (2011) argue that an organisation's focus

will shift towards achieving "optimal distinctiveness" in a competitive market (Brewer 1993). Similarly, Peng (2003) found incumbent firms are more likely to rely on informal and interpersonal relationships, which is a "relationship-based strategy" based on collective actions, during the early phase of institutional transitions due to lack of formal market institutions. Peng (2003) found organisations are more likely to adopt a market-based strategy primarily based on competitive resources and capabilities in the later phase of institutional transitions.

Interestingly, in this work it was found that Arup tried to establish a distinctive identity through demarcating novel market solutions at the earliest possible phase of the field emergence. Later than the market actions, the organisation was engaged with non-field actors that had diverse social and political backgrounds in several collective activities. The observation of Arup's socio-political approach is consistent with the sequential findings in Navis and Glynn's (2011) collective identity argument and Peng's (2003) relationship-based strategy. However, Arup's market-focused approach to individually establishing its distinctiveness during the earliest phase of field emergence does not match with the claim in both papers. We contend Arup's early market-focused approach effectively took advantage of the fact that any field at its early phase is highly vulnerable to the initial influences of field actors (Lawrence and Phillips 2004). An effective market-focused approach can quickly help organisations capture first-mover advantages; although sustaining the advantage in the long-term is not guaranteed by relying on market oriented actions only (Lieberman and Montgomery 1988, Suarez and Lanzolla 2005). Compared to Navis and Glynn's (2011) and Peng's (2003) studies that simplify the process of field emergence into two phases (early phase when fields lack of structures, rules and norms; later phase when fields become taken-for-granted), these findings regarding Arup's market-focused approach sounded the alarm, in that more attention towards the organisations' intentional actions at the earliest phase of field

emergence should be paid. In addition, the market-focused approach presented here differs from Peng's approach, a market-based strategy that is more suited to a mature market with rules and regulations having been established. Our market-focused approach emphasises the importance of establishing an early cognitive identity in the field as recommended by Sanots and Eisenhardt (2009).

4.6.3 Boundary Conditions

This study raises some intriguing suggestions that boundary objects and boundary infrastructure offer the potential to facilitate established organisations to conduct boundary work and establish novel practices in nascent fields (Table 4.2). Even though we have sought to develop a generally applicable framework, questions regarding the boundary conditions of the framework remain. We conceive such concerns need to be discussed from the following two aspects: 1) when boundary objects/infrastructure might perform such functions; 2) are there contextual factors that preclude such generalisations.

Carlie's (2002, 2004) integrative framework for managing knowledge across boundaries provides implications for human agency and effective leverage of boundary objects. He firstly scaled the circumstances of boundaries into three progressively complex levels based on Shannon and Weaver's (1949) framework: syntactic, semantic, and pragmatic. He then proposed that managing knowledge across the three levels of boundaries to foster innovation involves three progressively complex processes – knowledge transfer, translation and transformation (Carlile 2002). Similar progressively complex processes are reflected in our findings of Arup's adoption of the two different approaches. This is because establishing new practices in nascent fields is essentially a process of transmitting new knowledge across a syntactic boundary, translating new knowledge across a semantic boundary, and transforming new knowledge across a pragmatic boundary. In our case, visionary boundary objects offered Arup a shared syntax to communicate across barriers; structural boundary objects provide a

structured space to specify and translate the new design practices in front of diverse groups of market actors; and a boundary infrastructure (containing a system of boundary objects) facilitated the most complicated process where field and non-field actors can jointly transform and construct the new design practices as well as the emerging field.

Therefore, we borrow Carlie's (2002) suggestion to indicate for any boundary object to be effective in resolving problems at a given boundary, three characteristics of the boundary objects are necessary:

- "An effective boundary object establishes a shared syntax or language for individuals to represent their knowledge"
- "An effective boundary object at a semantic boundary provides a concrete means for individuals to specify and learn about their differences and dependencies across a given boundary"
- "An effective boundary object facilitates a process where individuals can jointly transform their knowledge at a pragmatic boundary"

Secondly our arguments are contextually contingent. Boundary objects themselves are not "magic bullets" and it is human agency's active work in differing settings (e.g. between established organisations and nascent fields) that makes them effective. The contextual factors for our findings are conditions characteristic of emerging fields where institutional infrastructure is weak and rules and conventions can be negotiated rather than dictated by organisational actors. Therefore, we recognised that boundary objects can be facilitative as well as inhibitory due to its nature of interpretive flexibility (Fox 2011). Although leveraging a boundary object/infrastructure in nascent fields provides organisations edge to facilitate communication and cooperation, which is crucial in the context of emerging fields, organisations should recognise its limitation in institutionalising new practices due to its openness to share and access. For example, Arup received negative public media responses to

their promoted Dongtan project after the project publicly announced its delay. In this regard, the public perception of the Dongtan project was no longer facilitative for Arup to socially construct their new design practices, but rather inhibitive. Therefore, for any organisation who conduct managerial agency in a nascent field, they need to be aware of such boundary conditions of leveraging boundary objects/infrastructure.

4.7 Conclusion

We conclude by summarising our contribution to the literature of institutional entrepreneurship and boundary objects more broadly. The study started with the initiative to understand and resolve one part of the theoretical puzzle in institutional theory: the paradox of highly embedded agencies operating in nascent fields. The puzzle was approached by dismantling the process that established organisations used to overcome their existing constraints and institutional environments to successfully enter nascent fields. This work primarily contributes to the institutional literature by introducing a new strategic mechanism, a boundary infrastructure (containing a system of interdependent boundary objects), which organisations employed to facilitate market-focused as well as socio-political approaches in the process. We argue that the entrepreneurial actions of early entrants in nascent fields are likely to be deliberate and emergent, which stand in sharp contrast with the notion of institutional entrepreneurship in mature fields, where actions are more purposeful in their way of changing existing institutional environments. The multi-facets of boundary infrastructures, with the nature of intrinsic, symbolic and interpretive flexibility (Star 2010), can play a pivotal role in facilitating the adoption of a deliberately emergent strategy in a nascent field associated with the liability of uncertainties and ambiguities.

The enabling conditions that bridge the boundaries between established organisations and emerging fields are also identified and highlighted in this work. Instead of simply attributing

the rationale to the pressure from the external macro climate (which is not this paper's focus), we argue that the real impediments for engaging in entrepreneurial actions are to do with organisations "motivation, power and capacity to act" rather than their structural constraint to new possibilities and opportunities (Farjoun 2010). The availability of a boundary infrastructure offers the promise for a shared context between organisations and nascent fields because it can convey localised and embedded knowledge of novel solutions across boundaries (Carlile 2002).

In addition, this paper adds to the discussion on the sequence of performing market-focused and socio-political actions. The existing literature has broadly divided the process of early institutional transitions into two stages: an early phase when fields lack institutional frameworks and a later phase when fields become more institutionalized. Matching the two stages of institutional transitions, scholars suggest organisations firstly place their emphasis on establishing a collective identity for the field through collective actions and secondly distinguish themselves through competitive market actions. These findings also support the existing argument by identifying contextual differences between the emergence of new fields and the transformation of existing fields. During the early phase of new field emergence, we argue that organisations intend to capitalize on their first-mover advantages and establish distinctive identities through market-focused actions. Baring the significant market costs for early market entry, organisations have strong motivation to take advantage of an unstructured market and institutional environment to create a distinctive identity for the firm. Since first-mover advantages are difficult to sustain over the long term, especially in the context of rapidly changing conditions (Suarez and Lanzolla 2005), organisations quickly take on brokering actions to arm themselves with useful ties and contacts, and construct a collective identity for the emerging field after the initial market approach (Burt 1997). The adoption of an early market-focused approach to create an early distinctive identity for the firms, and as a

consequent, a socio-political approach to create collective identity for the field, also reflects the contingent and emergent nature of nascent fields composed of rapid cycles of demarcation and institutionalization.

Lastly, our work has implications for the literature of boundary objects (infrastructure). The existing literature largely focuses on assessing the relationship between boundary objects and interdisciplinary collaborations, such as enabling knowledge transfer and negotiations between differentiated communities of practice. While, the leveraging of boundary objects in the context of an inter-firm and that conceptualized boundary objects can be managed to help bridge field and organisational boundaries, have been examined in this paper.

The limitations of this paper suggest opportunities for future research. It makes good sense for subsequent studies to explore whether the strategy of managing boundary objects to approach a nascent field can be generalized as an effective practice for entrepreneurial actions during field emergence. Other comparable contexts may need to be used to study the research findings further as the field of eco-city design may not be typical. Secondly, further research can investigate holistically how agencies manoeuvre boundary objects to both influence the external institutional environment and reinforce the newly established practice internally. The research towards the understanding of how boundary objects can be strategically leveraged to foster the development of organisational core capabilities in nascent fields would provide a more complete picture to explain the phenomenon.

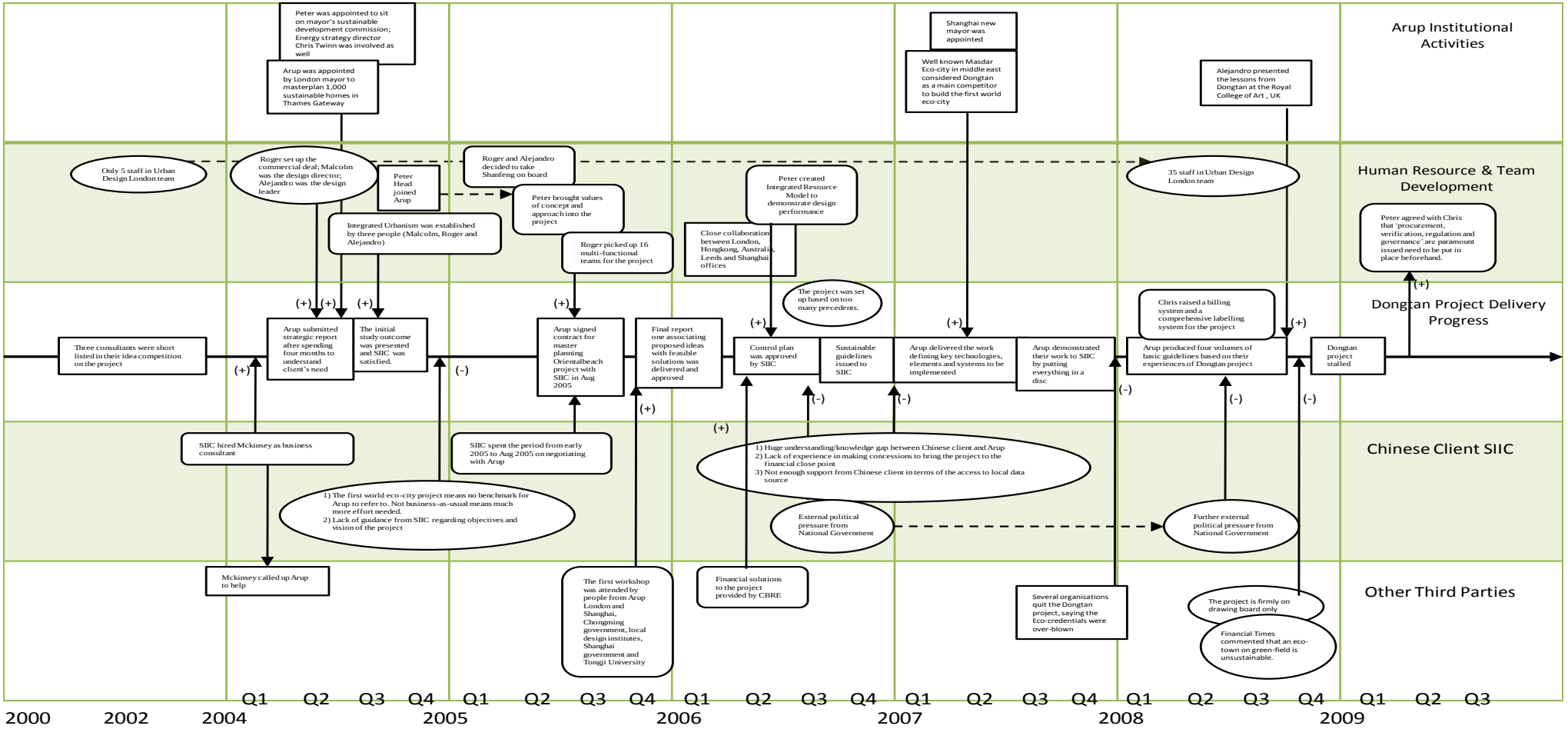
Appendix 4.1 – List of Interviews Recorded and Transcribed

Code	Date	Affiliation	Interviewee's Job title/Function	Description
1	September 2007	Arup Arup	Director of Planning Project Manager of Dongtan project	Face to face, UK
2	February 2008	Arup	Project Manager of Dongtan project	Face to face, UK
3	February 2008	Arup	Senior Architect	Face to face, UK
4	February 2008	SIIC	Client	Face to face, UK
7	February 2008	Arup	Senior Urban Designer	Face to face, UK
8	February 2008	Arup	Senior Economist, Associate	Face to face, UK
9	March 2008	Arup	Cultural planner	Face to face, UK
10	March 2008	Arup	Senior Environmental Consultant	Face to face, UK
11	March 2008	Arup	Senior Energy Engineer	Face to face, UK
12	March 2008	SIIC	Client	Face to face, China
13	March 2008	SDC Investment	Investment Consultant	Face to face, China
14	March 2008	Arup	Network Coordinator	Face to face, China
15	March 2008	Monitor Consultants	Consultant	Face to face, China
16	March 2008	Arup	Network Coordinator	Face to face, China
17	March 2008	Tongji University	Advisor to Shanghai Municipality on Dongtan project	Face to face, China
18	March 2008	Tongji University	Professors	Face to face, China
19	March 2008	SIIC	Client	Face to face, China
20	March 2008	Arup	Network Coordinator	Face to face, China
21	March 2008	Arup	Project Manager	Face to face, China
22	March 2008	Shanghai Municipality	Government Officials	Site Visit and meeting
23	April 2008	Arup	Project Manager	Face to face, UK

24	April 2008	Arup	Team leader in environment and sustainability design	Face to face, UK
25	April 2008	Arup	Senior Urban Designer	Collaboration meeting
26	April 2008	SDCL	Founder	Face to face, UK
27	May 2008	Arup	Global Head of R&D department	Face to face, UK
28	May 2008	Arup	Senior Urban Designer	Face to face, UK
29	May 2008	Arup	Economist, Associate Director	Face to face, UK
30	May 2008	Arup	Head of Energy Strategy, Managing Director	Face to face, UK
31	July 2008	Arup	Water strategy consultants	Face to face, UK
32	July 2008	Arup	Global Head of R&D department	Face to face, UK
33	July 2008	Arup	Energy strategy, Director	Face to face, UK
34	July 2008	Arup	Consultant	Telephone
35	July 2008	Arup	Project Director, Director of Planning	Face to face, UK
36	July 2008	Arup	Director of Communication	Face to face, UK
37	July 2008	Arup	Logistics, Associate Director	Face to face, UK
38	July 2008	Arup	Project Manager	Face to face, UK
39	July 2008	Arup	Project Manager	Face to face, UK
40	August 2008	Arup	Network Coordinator	Face to face, China
41	August 2008	SIIC	Vice President	Face to face, China
42	August 2008	Academics, SIIC and Arup	Workshop in Shanghai	Workshops
43	August 2008	SIIC	Manager	Face to face, China
44	August 2008	SIIC	Manager	Face to face, China
45	March 2009	Arup	Project Director, Director of Planning	Face to face, UK
46	March 2009	Arup	Senior Architects	Face to face, UK
47	March 2009	Arup	Senior Urban Designer	Face to face, UK
48	March 2009	Arup	Project Manager	Face to face, UK

49	March 2009	Arup	Dongtan design leader, Associate Director	Face to face, UK
50	June 2009	Arup	Sustainability Consultant, Director	Face to face, UK
51	June 2009	Arup	Chairman, Energy, Resource and Industry Market	Telephone
52	July 2009	Arup	Senior Architect	Telephone
53	July 2009	UCL	Professor of Planning	Face to face, UK
54	July 2009	Arup	Innovation, Associate Director	Face to face, UK
55	July 2009	Arup	Project Director, Director of Planning	Face to face, UK
56	May 2010	Arup	Workshop	Face to face, China
57	May 2010	Chongming Government	Workshop	Face to face, China
58	May 2010	Chongming Developer	Workshop	Face to face, China
59	May 2010	Tongji University	Professor of Architecture	Face to face, China
60	May 2010	Jinshan District Government	Workshop and field visit	Workshop
61	May 2010	Bluepath Consulting	General Manager, Senior Manager	Face to face, China
62	May 2010	Tongji University	Professor of Policy and Economics	Face to face, China
63	May 2010	Arup	Principle Senior Engineer	Face to face, China
64	May 2010	SIIC	Vice President	Face to face, China
65	May 2012	Arup	Senior Urban Designer	Telephone

Appendix 4.2 – Event Chronology for Dongtan Eco-city Project



Note: The form of the boxes indicates whether the event described represents a decision (round-cornered rectangles), an activity (sharp-cornered rectangles), or an event outside the control of the firm (ovals). The arrows leading from each box to the central band indicate the effect of this event on Arup's process of succeeding in the emerging field (positive effect [+], negative effect [-])

Appendix 4.3 – Assess Media Coverage of Arup and its Boundary Infrastructure

Management scholars have identified media reputation based on newspaper and online article coverage as a strategic resource leading to competitive advantage (Deephouse 2000, Earl, Martin et al. 2004). In this study, we used a combination of media content and coverage to assess Arup's field position during the formative phases of eco-city field (Rindova, Petkova et al. 2007).

The assessment of media coverage was based on a dataset collecting UK and US top ranking online newspapers because they are public, comprehensive and influential. To collect the media articles, we searched 'eco-city' or 'ecocity' in the UK and US Top 8 online newspapers across the time span 2005 – 2010. The search result returned 239 (UK) and 123 (US) news articles. Occasionally, these releases lacked relevant content (e.g., an article talking about Eco-city Vehicle instead of ecological city in the meaning is irrelevant); we removed the noise from our sample (n=28 for UK and n=65 for US), leaving 211 number of UK and 58 number of US news articles for our analysis. Table 4.4 shows the number of media articles collected from each top UK and US newspaper.

Number of Articles returned for search keywords 'eco-city' & 'ecocity'

(Search Period: 2005 – 2010)

UK Top 8 Newspapers (Ranking in 2010)				US Top 8 Newspapers (Ranking in 2010)			
	Relevant	Irrelevant	**Results**		Relevant	Irrelevant	**Results**
BBC	15	1	**14**	Business Week	60	42	**18**
Building	69	0	**69**	New York Daily News	0	0	**0**
Daily Telegraph	32	12	**20**	Reuters	49	21	**28**
Economist	9	0	**9**	The Florida Times Union	0	0	**0**
Financial Times	40	8	**32**	The New York Times	10	2	**8**

Guardian	48	3	**45**	The Wall Street Journal	3	0	**3**
New Scientist	10	2	**8**	The Washington Post	0	0	**0**
The Times	16	2	**14**	USA Today	1	0	**1**
Total	239	28	**211**	**Total**	123	65	**58**

Table 4.4 – Mainstream Media Article Dataset

In order to assess Arup's percentage of media coverage in the total eco-city media articles (UK=211 and US=58), we adopt the following criteria to carry out the search.

- Search for articles in which the content contains the words of the organisation 'Arup' in the media database. Read through each single article to confirm it includes Arup as appropriate written content.
- Search for articles in which the content contains the word of the boundary infrastructure 'Dongtan' in the media database. Read through each single article to confirm it includes Dongtan project as appropriate written content.
- Search for articles in which the content contains both the key words: 'Dongtan' & 'Arup' in the media database. Read through each single article to confirm it includes Arup and Dongtan project as appropriate written content.

We went through all the articles returned by using the above search criteria. The content of these media articles suggested that Arup disseminated stories through symbolic ceremonies and press releases so that they intertwined their organisational identity with the nascent eco-city field. The overall media coverage of 'Arup', 'Dongtan' and 'Arup and Dongtan' over the period of 2005 to 2010 is calculated in Table 4.5,

Number of Articles returned for search keywords 'Arup', 'Dongtan' and 'Arup' & 'Dongtan'

(Search Period: 2005 – 2010)

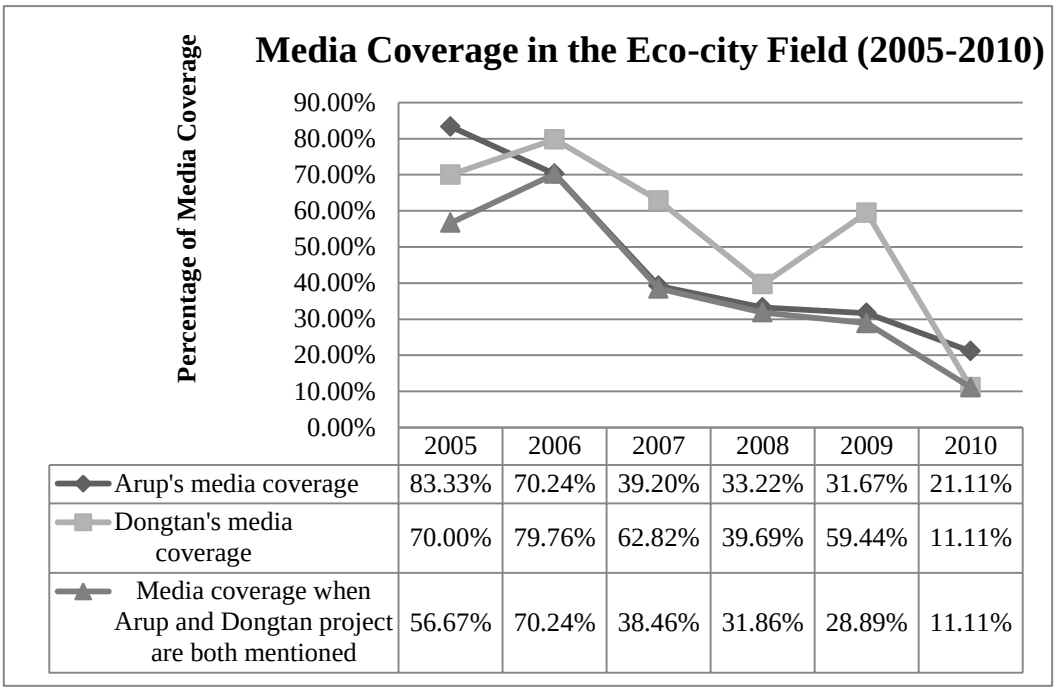
UK Top 8 Newspapers (Ranking in 2010)					**US Top 8 Newspapers (Ranking in 2010)**				
	Total No. of Eco-city	No. of Articles with Keyword	No. of Articles with Keyword	No. of Articles with Keywords		**Total No. of Eco-city**	No. of Articles with Keyword	No. of Articles with Keyword	No. of Articles with Keywords

	Articles	'Arup'	'Dongtan'	'Dongtan' & 'Arup'		**Articles**	'Arup'	'Dongtan'	'Dongtan' & 'Arup'
BBC	**14**	3	7	4	Business Week	**18**	5	5	4
Building	**69**	42	43	36	New York Daily News	**0**	0	0	0
Daily Telegraph	**20**	7	7	6	Reuters	**28**	4	7	5
Economist	**9**	3	4	3	The Florida Times Union	**0**	0	0	0
Financial Times	**32**	12	20	12	The New York Times	**8**	2	3	2
Guardian	**45**	12	20	12	The Wall Street Journal	**3**	1	1	1
New Scientist	**8**	1	3	1	The Washington Post	**0**	0	0	0
The Times	**14**	6	4	4	USA Today	**1**	1	1	1
Average percentage of media coverage		**36.8%**	**46.8%**	**33.8%**	**Average percentage of media coverage**		**22.4%**	**29.3%**	**22.4%**

Table 4.5 – Media Coverage of Arup and Dongtan Project in UK and US Top Newspapers During the Period of 2005 - 2010

- In the UK media article dataset, on average Arup appeared in 37% of eco-city related newspaper articles; Dongtan project appeared in 47% of eco-city related newspaper articles; and 34% of total articles mentioned Arup and Dongtan project simultaneously.
- In the US media article dataset, on average Arup appeared in 22% of eco-city related newspaper articles; Dongtan project appeared in 29% of eco-city related newspaper articles; and 22% of total articles mentioned Arup and Dongtan project simultaneously.

The above results suggest Arup achieved significant media coverage (close to 40%) in the topic of eco-city during the period of 2005 - 2010. Using the same methodology, we calculated the media coverage for the organisation and the project in each year and showed the results in Figure 4.2. We do not show the results returned from assessing the US dataset due to its small sample size.



	2005	2006	2007	2008	2009	2010
Arup's media coverage	83.33%	70.24%	39.20%	33.22%	31.67%	21.11%
Dongtan's media coverage	70.00%	79.76%	62.82%	39.69%	59.44%	11.11%
Media coverage when Arup and Dongtan project are both mentioned	56.67%	70.24%	38.46%	31.86%	28.89%	11.11%

Figure 4.2 – Media Coverage of Arup and Dongtan Project

The above figure suggests Arup became market cognitive referent after achieved significant media coverage in 2005 and 2006. Achieving the high media coverage in the early two years matches with the timing when Arup mainly undertook market-focused actions at the earliest stage of the market emergence.

Meanwhile, the media coverage of the Dongtan project (the conceptualized boundary infrastructure) presents a strong co-relationship with the coverage of Arup, which indicates Arup leveraged the boundary infrastructure to achieve the early cognitive dominance.

From 2007 to 2010, the media coverage of Arup as well as the Dongtan project decreased quickly. The reduced figures actually match with our findings that the organisation took social and political activities rather than focusing on promoting the only market practices. Arup expanded its sphere of influences through engaging collective efforts surrounding the notion of the boundary infrastructure. According to our content analysis of media dataset, Arup was more often covered in various eco-related businesses instead of just eco-city projects. As such, the organisation continuously consolidated its eco-city market base and expanded its influences in other eco-related businesses.

Finally the above observation can be triangulated with the interview dataset. For example, some interviewees contended that the media reputation of the Dongtan project would be

firm's 'eco-city badge' in the future; Dongtan was 'the most amazing marketing bits' for Arup that they had ever longed for; while others implied that the Dongtan project could become a milestone memorizing that Arup helped China make great impacts on tackling climate change.

Chapter 5

BRIDGING RESOURCE-BASED AND INSTITUTIONAL PERSPECTIVES IN EMERGING FIELDS

Research Notes and Commentaries

ABSTRACT

A contribution is made by this theoretical paper by suggesting the possibility of integrative efforts. By focusing on strategic actions of organisations in emerging fields, our paper presents possibilities for closer interactions or even synergies between two literature streams: dynamic capabilities in resource-based view and institutional entrepreneurship in institutional theory. The key contribution of the paper not only lies in the consideration that the phenomenon of field emergence involves both literatures, but the explanation how these two literatures interact in essential ways. The paper suggests future research should promote a structured representation of problem setting that organisations are facing when they make strategic choices to enter nascent fields.

Keywords: resource-based view, institutional theory, dynamic capabilities, institutional entrepreneurship, nascent markets

5.1 Introduction

Management scholars have highlighted the significance of the relationship between organisations and their institutional environment (Lawrence and Lorsch 1967, Galbraith 1973, Pfeffer and Salancik 1978, Smith and Cao 2007). Most studies approach this topic either through the lens of an organisation or originating and building from an environmental perspective. Significant contributions have been made to the field by resource-based view and institutional theory in their own right in addition to them being featured in the topic. For scholars holding a resource-based view, resources and capabilities are the sources of firms' heterogeneity (Penrose 1959, Barney 1991) and sustainable competitive advantages. For scholars studying institutional theory, they use the influence of the institutional environment to explain homogeneity of organisational forms and practices (DiMaggio and Powell 1983, Tolbert and Zucker 1983). The resource-based view argues that organisations integrate, reconfigure, gain, and release resources to evolve, adapt or change their institutional environment (Eisenhardt and Martin 2000); while institutional theory highlights social norms, rules, and taken-for-granted conventions in the institutional environment that defines or enforces the organisational conduct and practice (DiMaggio and Powell 1983, Scott 1987, DiMaggio 1988, Scott 1995, Suchman 1995). The important topic of the firm-environment relationship is addressed in both theoretical perspectives, but in each some aspects are emphasised at the expense of others.

Conceptualizations of the phenomenon shall not be dictated by the existing available theoretical tools (Foss 1999). Although both theories employ rigorous methodologies to examine the relationship, the theories can sometimes become limited when they are "alternative cuts" of a multifaceted reality (Poole and Van de Ven 1989). For example, some firms look beyond their own resource and market characteristics and play a more active role

in the institutional environment including government, society, and inter-firm relationships. Without incorporating the nature of social context into an analysis, it is difficult to understand how firms go beyond pure economic rationales to make their resource selections (Oliver 1991). If a single theory cannot be used to provide a full description of a phenomenon it is necessary to integrate several different ideas or strands from a variety of theories.

Emerging fields provide an important but under-researched empirical context to test and extend existing theories explaining the interactions between organisations and the environment (Navis and Glynn 2010, David, Sine et al. 2012). Surprisingly, most of the literature has largely focused on organisational work in institutionalized fields where the "rules of the game" are taken for granted and field changes are slow and incremental (Greenwood and Suddaby 2006). Some scholars speculated that the reason for fewer studies in the institutional environment with low levels of institutionalization was due to the challenge of explaining "how do organisations play the new game when the new rules are not completely known" (Peng, 2003: 283). Indeed, emerging fields raise different challenges confronting organisations compared to established fields that are relatively stable institutionally. Within an emerging field, institutional infrastructures are likely to be weak and institutional environments are dynamic and ambiguous. Firm's strategic decisions are likely to differ when uncertainty plays an important role in the prediction of the dynamics between the organisation and the environment.

This research note adds theoretical insights on strategic organisational behaviour in emerging fields. To introduce this topic, we reveal the contribution of two related theories – resource-based and institutional views. Our study starts from Oliver's (1991) influential initiative to converge both theoretical perspectives, and we assess the existing theoretical groundings for combining the two strands of literature. In particular, we are interested in understanding how each item in the literature helps capture the complex relationships between organisations and

the context of emerging fields. Our review reveals that entrepreneurial actions play a paramount role in shaping organisations' strategic behaviour in an emerging field; thus, we shifted our focus towards the concepts of dynamic capabilities and institutional entrepreneurship to understand how their convergence can provide constructive insights. We built the foundation for the consensus by recommending a multi-level study of paradoxical challenges, complementing theoretical limitations in each perspective and suggesting a dynamic view of firm boundaries contingent to the uncertainty level during field emergence. We draw our concluding remarks with future research possibilities.

5.2 Theoretical Groundings

5.2.1 Combining Resource-based and Institutional view

Over two decades ago, Christine Oliver's Academy of Management Review paper set a promising research agenda for converging insights from the resource-based view and institutional theories. The paper makes a fundamental argument that firms need to be capable of incorporating the development of institutional capital with the optimal use of resources to earn above average rents.

The central theme of the resource-based view (RBV) adopts an economic approach to understand "why firms differ". RBV argues that VRIN (valuable, rare, inimitable and non-substitutable) resources are sources of firm heterogeneity (Barney 1991, Langley 1999) and explains that firms are able to integrate, reconfigure, gain, and release resources in response to the external environment (Eisenhardt and Martin 2000). A prominent emphasis has been placed by existing studies related to RBV on the economic rationality of resource decisions as well as the efficiency and profitability of the organisational work (Conner 1991). However, RBV has been criticized for its lack of attention to inter-firm relationships and structures

which underpin the creation and configuration of a firm's resources and capabilities (Dunning and Lundan 2010). The allocation and configuration of resources need to be consistent with the firm's historical, cultural or political context and it is actually the institutional context surrounding resource decisions that accounts for a firm's potential to earn economic rents. For example, Oliver (1991) theorises that both resource and institutional capital should be considered as sources of competitive advantage and points out how the interactions between 'strategic and institutional isolating mechanisms' occur at the individual, organisational, and inter-firm levels of analysis. Santos and Eisenhardt (2004) recommend firms to maximize the fit between their resource configurations and embedded institutional context; while Peng (2003) simplifies a firm's rent potential as the interdependence of choice and constraints in organisational behaviour. Organisational capabilities, another fundamental construct in the resource-based view, are also recognized as being a matter of shared context and cognition (Nahapiet and Ghoshal 1998). Capabilities can be socially constructed when organisations are embodied as members of credentialing institutions which regulate industry rules and norms. Connecting capabilities to a social process of legitimization would broaden RBV (Rao 1994). To summarize, scholars holding a RBV accept that organisations capture economic values associated with its VRIN resources, meanwhile these organisations accept, adapt to, and capitalize on the heterogeneity of institutional environments (Teece 2006).

Given the rise of new institutionalism which has flourished in social science in recent decades (North 1990, Scott 1995, Oliver 1997, Williamson 2000), the proposition "institution matters" becomes hardly controversial and speaks volumes about the particular usefulness of the institutional perspective. Institutional theory (DiMaggio and Powell 1983, Scott 1987, DiMaggio 1988, Scott 1995) directs attention beyond the boundary of the organisational phenomenon to the realm of social processes. Referred to as established rules, norms, and beliefs, the institutional environment constrains or enforces economic conduct, for example,

isomorphic pressure driving the processes of legitimization (DiMaggio and Powell 1983, Scott 1987, DiMaggio 1988, Scott 1995, Suchman 1995). Thus institutions facilitate economic interactions, or at least are perceived to, by reducing uncertainty and establishing trustful and stable infrastructures (North 1990). Different to the properties of resources and economic markets, institutional theory extends the motives of organisational behaviour (e.g. resource allocation) beyond an economic and efficiency-based explanation to social justification and social obligation (Zukin and DiMaggio 1990). Organisational forms and actions are seen as choices determined and constrained by social conventions in their institutional context (Scott 1987). However, institutional theory has been criticized for its overemphasis on market, cultural and political pressures constraining organisational behaviour and lack of attention to the strategic responses from organisations. Moreover, it has been identified that it is important to have an understanding of how institutions facilitate organisational strategies and also encourage entrepreneurial actions. For example, some disembedding and re-embedding of economic activities are actually corresponding rather than alternative processes due to institutional change (Peng 2003). Institutional theory provides a good foundation for understanding the relationship between organisations, their strategies, and institutional contexts (Lawrence, 1999), but falls short when offering insights from an organisational perspective (Table 5.1).

	Resource-based view of the firm	Institutional view of the firm
Primary question	What is the source of firm heterogeneity?	What is the source of firm homogeneity?
Theoretical focus	Economic rationality of resource decisions and efficiency and profitability of organisational work	Normative rationality of resource decisions and legitimacy of organisational conduct and practice
Level of analysis	Individual – Firm	Firm – Institution
Limitations	Lack of attention to inter-firm structures and institutional context that underpin the accessing, creation and usage of organisational resources	Lack of attention to strategic responses from organisations and overemphasis on market, cultural and political pressures
Rationale for convergence	Both resource and institutional capital are sources of competitive advantages for firms	

Table 5.1 – Theoretical Groundings for Combining Resource-based and Institutional View

While taking the notion of integrating two theories as the first step, working out the analytical logic and explicating the underlying mechanisms are the next steps which remain largely unknown in the literature (Williamson 2000, Peng 2002). Finding the analytical logic is essential because theory convergence requires binding ingredients that can sufficiently glue the seemingly disparate branches of insights and argument. Among different institutional conditions that require various approaches to be taken with regard to the topic, emerging fields in particular provide an intriguing context to converge the insights form resource-based and institutional views. This is because studies covering emerging fields indicate a more inseparably interwoven relationship between organisations and institutional environment due to high degrees of uncertainties and ambiguities. As the emergence of new fields generates novelty, change, and uncertainty at both organisational and institutional levels when they first

appear, the emerging fields generate great opportunities to extend and develop existing theories (Wright et al, 2005). In the following section, we review how each strand of the literature contributes to the dialogue and discuss the linkages between them.

5.3 Bridging Resource-based and Institutional Perspectives in Emerging Fields

Emerging fields (i.e. technology innovation in personal mobile service, sustainable development in urban water, transport and electricity grids), also categorised as 'high-velocity' markets (Eisenhardt 1989), are business environments undergoing rapid evolution in their early formative phases. Organisations which are apt to enter emerging fields often confront the real challenges of blurred market boundaries, untested technologies or business models, and ambiguous or ill-structured industries (Tushman and Anderson 1986, Santos and Eisenhardt 2009). The lack of institutionalized practices is not only a significant institutional problem but also generates business opportunities that a competitive organisation could capitalise on. As suggested by DiMaggio (1988:14), new fields arise when "organised actors with sufficient resources see in them an opportunity to realise interests that they value highly". The emergent business opportunities require organisations to possess different types of capabilities to enter and thrive in an emerging field. For example, one set of capabilities prevents development of organisational inertia and encourages new market entry by creating innovative market solutions (i.e. new products or practices) (King and Tucci 2002). Another type of capability points to an organisations' ability to overcome the difficulties of addressing the lack of stable roles and relationships or even navigate the new belief systems in the emerging fields.

Two concepts – dynamic capabilities and institutional entrepreneurship, from resource-based and institutional perspectives respectively – capture key attributes of the intriguing dynamism in emerging fields. The organisations' ability to battle, survive or prosper in a fast changing environment is determined by dynamic capabilities, and organisations' determination of influencing the formation of new conventions in emerging fields is facilitated by institutional entrepreneurship. We introduce how each piece of the literature has yielded relevant insights and explain why bridging them and investigating the connections between them would build foundations for research in the context of emerging fields.

5.3.1 Dynamic Capabilities Perspective

RBV has been criticized for its inability to explain sustainable competitive advantages when it is being used to study situations that are in the context of volatile and unpredictable environments. The recent salient concept dynamic capabilities enhances RBV as a way of encapsulating the evolutionary nature of resources and capabilities to address rapidly changing environments (Teece, Pisano et al. 1997, Eisenhardt and Martin 2000, King and Tucci 2002, Zollo and Winter 2002, Zahra, Sapienza et al. 2006, Helfat, Finkelstein et al. 2007, Teece 2007). The literature shows that organisations benefit from having dynamic capabilities when entering new market arenas since the concept addresses managerial strategic flexibility of capability development (King and Tucci 2002, Uhlenbruck, Meyer et al. 2003). Similarly, Eisenhardt and Martin (2000:1007) implied that dynamic capabilities are "organisational and strategic routines by which firms achieve new resource configurations as markets emerge".

While the conception of dynamic capabilities emphasises its contingent nature with the degree of market dynamics (Eisenhardt and Martin 2000), organisational theorists also paid attention to the dynamism of capabilities. As we reviewed prior definitions (Chapter 2), we

find that two key words "*entrepreneurship"* and *"change"* are rooted in the nature of dynamic capabilities. The foregoing research has illustrated its intention to highlight the entrepreneurial characters of dynamic capabilities to define, discover and exploit opportunities. As Zahar et al. (2006) revealed, "A new routine for product development is a new substantive capability but the ability to change such capabilities is dynamic capabilities". In contrast to operational/core capabilities, dynamic capabilities concern *change* (Helfat, Finkelstein et al. 2007). Dynamic capabilities help to *change* organisations' operating routines when there appears to have a misfit between firms and volatile environment (Nelson and Winter 1982, Winter 2000). Theorised as a higher-order ability (Winter 2003), a dynamic capability refers to the capacity of an organisation to purposefully *change* their core capabilities – a bundle of a firm's fundamental resources and capabilities. When core capabilities become 'core rigidities' and create a 'competency trap' (Leonard‐Barton 1992), dynamic capabilities enable organisations to embark upon new activities to rejuvenate (*change*) themselves, which is important for identifying and sensing the opportunities unfolded in emerging fields (White 2000).

The concept of dynamic capabilities provides theoretical explanations of firms' resource and capability rejuvenation by undertaking entrepreneurial activities, but the literature reveals that researchers have tended to reflect such responses to volatile environments as normally post hoc and reactive (Dunning and Lundan 2010). This could be due to conceptualization or assessment of the dynamic capabilities in ways that infer the concept so it is close to the final effect. It may also be due to the difficulty of gaining access to study managers and entrepreneurs before they build or change core capabilities (Zahra, Sapienza et al. 2006). But the truth is dynamic capabilities have rarely been examined in cases of changing or shaping their external environments instead of addressing or adapting. When organisations confront an emerging field associated with both business opportunities and extremely ambiguous

norms and rules, what dynamic capabilities are required, to succeed in shaping and changing the external environment, is the question barely asked in the literature (McKague 2011).

5.3.2 Institutional Entrepreneurship Perspective

In light of the critique of institutional theory for its inability to explain fundamental change (DiMaggio 1988), a surge of interest in the role of the agency has emerged with the idea of institutional entrepreneurship (Hardy and Maguire 2007). Institutional entrepreneurship provides an explanation for institutional creation or change, and highlights the way in which actors work towards their strategic objectives to change or shape their embedded institutions (Garud et al., 2002; Oliver, 1991). Due to the lack of structure and high levels of uncertainty it has been highlighted that the institutional environment encountered in emerging fields would provide insights towards theorizing the process of institutional entrepreneurship (Rao 1994, Lawrence 1999, Maguire, Hardy et al. 2004, Garud, Hardy et al. 2007, Maguire 2007). For example, DiMaggio (1988) and Phillips et al. (2000) suggest that unstructured contexts and uncertainty in the institutional environment provide opportunities for strategic actions like institutional entrepreneurship. Fligstein (1997:401) proposes a low degree of institutionalisation as an enabling condition for institutional entrepreneurship because "possibilities for strategic action are the greatest" when organisational fields have no structure.

Past studies normally examine the literature in two themes: the enabling conditions for institutional entrepreneurship and the process by which institutional entrepreneurship unfolds (Garud, Hardy et al. 2007, Hardy and Maguire 2007, Leca, Battilana et al. 2008). Interestingly, the same keywords "*entrepreneurship"* and *"change"* underpin the essence of the institutional entrepreneurship concept. Taking an *entrepreneurial* initiative from institutional theory, the conception reflects that actors conducting *entrepreneurial* activities

to bounce back to the institutional pressures (Oliver 1991, Oliver 1992) and empowering themselves to *change* the institutional order of organisational fields (Lawrence 1999). Emerging fields offer potential business opportunities but are difficult for grasp because organisations must deal with a highly unpredictable environment. Organisations need to conduct *entrepreneurial* actions to trigger institutional consequences because adopting existing ways of doing things without *entrepreneurship* makes *change* difficult to accomplish (Garud and Karnøe 2001). Institutional entrepreneurship, which is parallel to dynamic capabilities, prioritises actions that enable change at the institutional-level rather than the firm-level. Therefore Hoskisson et al (2000) speculated that as fields emerge, institutional-based view would become more relevant and dominant guiding strategy research in the context of emerging fields.

5.3.3 Research Approaches to Bridging Dynamic Capabilities and Institutional Entrepreneurship

What has emerged at this point is that bridging the framework of dynamic capabilities and institutional entrepreneurship would advance theory and research in emerging fields (i.e. developing economic markets). We next turn our focus to developing underlining mechanisms for such convergence. Based on the research outcome in Chapter 3 and Chapter 4, we suggesting the integration work may consider taking the following three research approaches: 1) resolving paradoxical persistence at firm and field levels simultaneously, 2) spanning literature voids and connecting complementary areas, and 3) examining processes of blurring and reshaping organisational boundaries

Resolving paradoxical persistence at firm and field levels

Following from the prior review, two key characteristics; *"entrepreneurship"* and *"change"* come to the fore when the theoretical perspectives are examined in the empirical setting of emerging fields. The common underlying argument for both perspectives is that

entrepreneurship is the engine of *change* at both organisational and institutional levels. Conducting entrepreneurship to accomplish *change* is not easy. The juxtaposition of dynamic and rigid forces as well as that of institutional and entrepreneurial forces into each single concept reflects a real decision dilemma that any manager is likely to face during field emergence. In other words, the highlight of *"entrepreneurship" and "change"* in each body of the literature points to the longstanding 'stability and change' paradox at both organisational and institutional levels.

Dynamic capabilities are needed upon when organisations are presented with the paradox of 'stability and change' during periods of transitions (Schreyögg and Kliesch Eberl 2007). On one hand, organisational change (e.g. resource creation, accumulation, deployment and reconfiguration) is imperative to keep pace with the changing environment. On the other hand, changes are difficult to incorporate as there are core rigidities that come from the established core capabilities and organisational inertia.

Institutional entrepreneurship presents the paradox of 'stability and change' by positioning structure and agency in the form of mutual constitutive duality (Seo and Creed 2002, Farjoun 2010). The concept places the emphasis on institutional embeddedness of the agency addressing the dilemma, "How can actors change institutions if their actions, intentions, and rationality are all conditioned by the very institution they wish to change" (Holm, 1995:398). As such, institutional entrepreneurship explores the rationale and processes of actors embedded in institutional arrangements trying to navigate institutional contexts with creative ideas.

To this point, both parts of the literature have relied on the paradox perspective to conceptually frame organisational strategic choices across various levels. Studies in both parts of the literature try to dissolve and transcend the 'stability and change' paradox in the

process of implementing strategic decisions inside and outside of organisational boundaries. Some scholars, who see paradoxes as problems that need to be solved provide extensive analysis to do this. Yet, others consider that the seemingly paradoxical persistence propels and unfolds the process of *change* at an analytical level (Quinn and Cameron 1988). Poole and Van de Ven (1989) proposes such a way of looking into theoretical tensions as a strategy for theory building. Using a paradox as "a thought-provoking tool or perspective" (Lewis, 2000:774), scholars can illustrate conflicted yet interwoven facets of organisational phenomena with grounded theoretical explanations. In Chapter 3, by unpacking the notion of dynamic capabilities from a paradoxical perspective, we explicate how capability change reciprocally interacts with capability stability. When the conceptual model demonstrates that stability and change can reinforce, rather than negate, each other during the process of capability development, the seeming paradox is resolved. In Chapter 4, we empirically demonstrated that structural embeddedness can not only undermine change but also become the enabling conditions for institutional change. The seemingly paradoxical dilemma for the established organisation to enter a nascent eco-city design field actually had more to do with whether they have the intentions and pathways to enable change (in our case, the pathway is provided by a boundary infrastructure), but less to do with agency's structural embeddedness in the existing field. Therefore, when exploring an organisational based model of competitive advantages during times of field emergence, we contend that researchers would benefit from adopting a paradoxical perspective to examine both stable and dynamic processes that are simultaneously visible at multi-levels. In other word, integrating studies of entrepreneurial actions vertically to tackle the multi-level paradoxes would be fruitful for the consensus.

Spanning literature voids and connecting complementary areas

The two different and imperfect parts of the literature also provide a research avenue by spanning literature voids and connect complementary areas to generate theoretical insights.

When putting it simply, the interactions between the institutional configurations and new capability development are rarely acknowledged in the dynamic capabilities literature (Dunning and Lundan 2010). Taking it one step further, the concept has been rarely studied in light of its role in fostering institutional entrepreneurship in an unregulated environment such as emerging fields (North 1990, McKague 2011). This is consistent with Rao's (1994) argument that RBV largely overlooks the institutional process of legitimisation. On the other hand, institutional entrepreneurship calls for the restoration of the agency effect to the analysis; however, it is very unclear when the literature explains the resources and capabilities required for institutional entrepreneurship. Considering the limitations of each part of the literature as an opportunity for theory building, we posit that future examination shall account for the fact that the development of dynamic capabilities is institutionally contingent, and the implementation of institutional entrepreneurship may be impeded by the lack of sufficient resources and capabilities within firms (Uhlenbruck, Meyer et al. 2003, Wright, Filatotchev et al. 2005).

Concerns that more dialogues between the entrepreneurship and institutional entrepreneurship parts of the literature are needed has also inspired our contention (Phillips and Tracey 2007, Tracey and Phillips 2011). Papers suggest that the concept of entrepreneurial capabilities in the entrepreneurship literature has not been "systematically applied to the institutional theory" (Philips and Tracey, 2007:316). By definition, entrepreneurial capabilities refer to "the ability to identify a new opportunity and develop the resource base needed to pursue the opportunity" (Arthurs and Busenitz, 2006: 199), which has been widely used to explain effective entrepreneurial activities. Similar to entrepreneurial capabilities in terms of explication of resource-base change, dynamic capabilities place more emphasis on existing resource recombination as a result of examining extant opportunities rather than the identification of a new opportunity and creation of a new resource base

(Alvarez and Barney 2005, Arthurs and Busenitz 2006). However, since both concepts have substantial relevance to the notion of entrepreneurship and imply a dynamic relationship between actors and their environments, dynamic capabilities just like entrepreneurial capabilities can still make contribution to the study of institutional entrepreneurship (Phillips and Tracey 2007).

As we have focused on emerging fields our attention has also been directed to review the dominant debate related to institutional entrepreneurship in the neo-institutional analysis (Scott 1987, Selznick 1996). The recent work on institutional entrepreneurship has celebrated the agencies' ability to create, change and transform existing institutions (Fligstein 1997). However, we argue that even when organisations undertake purposive actions to bring out changes in their institutional environment, they could still face both intended and unintended consequences. Particularly in emerging fields where the institutional framework is unstructured and weak, organisations are more likely to become involved in a reciprocal process in which they deliberately take entrepreneurial actions to shape institutional infrastructure as well as engage with a wide array of actors and activities to cope with emergent consequences (See Chapter 4). In such circumstances, organisations need to frequently monitor their existing resource base within the external changing environment and use dynamic capabilities to specify and develop resources required to respond to any emergent consequences in an ambiguous emerging field.

Therefore, there is an opportunity to expand the notion of dynamic capabilities shifting the focus on intra-organisational practices towards a more institutional-based view of firms' strategy in the context of emerging fields (Peng 2002, Peng, Wang et al. 2008, Dunning and Lundan 2010). Similarly, a capability-based view of the firm can contribute to the notion of institutional entrepreneurship focusing on field-wide processes in the context of the emerging fields (Lounsbury and Crumley 2007, Phillips and Tracey 2007). By giving the

entrepreneurial actions at the organisational and field levels equal billing, a more distributed understand of organisations' strategic choices during field emergence emerges.

Examining processes of blurring and reshaping organisational boundaries

Since Coase's (1937) article asked what determines where firm boundaries are drawn, the study of organisational boundaries has spawned a large body of studies on how organisations interact with environments. Primary theoretical explanations hold the argument that boundaries refer to the demarcation between organisations and the environment (Santos and Eisenhardt 2005) and boundary decisions are made in the locus of minimizing transaction costs (Williamson 1981, Williamson 1989). Indeed, such an exchange-efficiency perspective of boundaries largely fits well with a stable institutional environment where economic competitions dominate. In the setting of emerging fields, where market efficiency is rarely established, boundary decisions are more likely to be influenced by organisational competences (resource-based view) as well as influences (institutional-based view) (See Chapter 4 for a blended market-focused and socio-political approach). We make the argument that bridging the notion of dynamic capabilities and institutional entrepreneurship can augment the explanation of how organisational boundaries are blurred and reshaped. Also, the dynamic view of firm boundaries is enforced through the intervention of the uncertain and ambiguous conditions in emerging fields. We hereby unfold the process of agency in an evolving emerging field by employing the concept of dynamic capabilities as well as institutional entrepreneurship.

In an emerging field that has far from perfect competition, dynamic capabilities firstly become crucial because organisations need capability change to enhance competencies so that they can co-evolve the boundaries of internal resources with emerging market opportunities. When an organisation strategically blends existing resources with new ones to create novel market solutions, they have the opportunity to bridge the boundaries between the

organisation and emerging fields. However, organisations may make the boundary decision that they do not want to enter the new product/market domains. This could be due to the cost of entering a nascent field with a new practice which is significant. In other words, when organisations rely on dynamic capabilities to move increasingly away from their core market bases, they also need to allocate resources to establish themselves in the new fields. The resources allocated to institutional entrepreneurship are in particular the ones that will sustain the cost of maintaining the first-mover advantage for pioneer firms entering an emerging field. This cost could be even higher in that first-movers bear the costs and risks associated with product and market development (Lilien and Yoon 1990, Srinivasan, Lilien et al. 2004, Suarez and Lanzolla 2005).

To succeed in emerging fields, entrepreneurship in both contexts – overcoming internal paradoxical persistence to create new practices/products and external paradoxical persistence to legitimate new practices – are likely to occur to organisations after they make boundary choices to enter emerging fields. Organisations should be aware that the implementation of entrepreneurship at both levels consumes significant resources and effort. Once a boundary decision is made, organisations would confront the challenge of resolving the paradox of 'stability and change' across internal and external contexts simultaneously. Consequently, the strictness of organisational boundaries starts to diminish when organisations act to buffer the uncertainties within the organisations as well as emerging fields. Organisations create a managerial framework to grow abundant and coordinate 'upstream' and 'downstream' parts of their entrepreneurial activities at the same time. Thus, the boundaries of the firm become blurred and dynamic as a result of the organisations' involvement in the reciprocal processes of bridging the implementation of dynamic capabilities and institutional entrepreneurship. The boundary choices made by firms are affected by the level of uncertainty in the process of field emergence, which plays a central role.

5.4 Concluding Remarks

As an extended discussion to the research findings in Chapter 3 and 4, this Chapter contributes by offering research commentaries on possible integrative efforts. The work begins with reviewing general theoretical groundings for combining resource-based view and institutional view adopting an Oliver (1997) approach. When considering the underlying analytical logic for theory convergence, the work suggests the research setting of emerging fields provide an intriguing context because it not only indicates a more inseparably interwoven relationship between resource-based and institutional-based view of organisational activities, but also provides opportunities to challenge the strengths of these different perspectives under the conditions of weak institutional establishment (Hoskisson et al, 2000). By focusing on organisations' strategic actions in emerging fields, this work presents possibilities for closer interactions or even synergies between two literature streams from resource-based and institutional views: dynamic capabilities and institutional entrepreneurship. The key argument not only lies in the consideration that the phenomenon of field emergence involves both parts of the literature, but in the explanation of how these two parts interact in essential ways. Table 5.2 illustrates three potential research approaches as well as the potential resulting analytical logic to inform the integrative effort.

	A dynamic capabilities perspective	**An institutional entrepreneurship perspective**
Theoretical focus	Resource and capability rejuvenation to sense and seize opportunities in emerging fields.	Organisations empower themselves to shape institutional environment for emerging fields.
Comparison	Entrepreneurial activities at firm level	Entrepreneurial activities at institutional level
Rationale for consensus	High degree of uncertainty in emerging fields requires organisations to take entrepreneurial actions at organisational and institutional levels.	
Desirable	Give entrepreneurial actions at organisational and field levels equal	

outcome	billing to study a more distributed organisational model of competitive advantages during field emergence.	
Approach 1: Resolve paradox of 'stability and change' at multi-levels	Overcome capability rigidity to keep pace with the changing environment in emerging fields (Chapter 3).	Overcome agency's embeddedness in existing fields to navigate institutional environment in emerging fields (Chapter 4).
Resulting analytic logic	Adopt a paradoxical approach to examine stable and dynamic processes simultaneously visible at multi-levels.	
Approach 2: Span literature voids and connect complementary areas	Dynamic capabilities rarely acknowledge the interactions between institutional configurations and new capability development (Chapter 3).	In an emerging field, institutional entrepreneurship is likely to involve deliberate and emergent actions. The unintended consequences of institutional entrepreneurship require organisations to use dynamic capabilities to decide following strategic actions (Chapter 4).
Resulting analytic logic	Examine how institutional environment of emerging fields affects firms' development of dynamic capabilities. Examine how to maximize the fit between organisational resources and the changing nature of emerging fields. Key references refer to Peng (2002) and Hoskisson et. al. (2000).	Examine how dynamic capabilities foster the activities of institutional entrepreneurship in emerging fields. Key references refer to Philips and Tracey (2007) and Dunning and Lundan (2010).
Approach 3: Examine organisational boundary process	Evolve internal boundaries of resource allocations with the changing external environment.	Establish external influences and organisational identities in emerging fields.
Resulted analytic logic	Longitudinally examine the movement of firm boundaries in an evolving field context which is likely to be composed of rapid institutionalization cycles.	

Table 5.2 – Bridging the Notion of Dynamic Capabilities and Institutional Entrepreneurship in the Context of Emerging Fields

This above research commentaries also shed important light on future research agenda that this thesis has started devoting effort to contribute. For example, the timing and sequencing of implementing managerial actions at both firm and field levels have not been theoretically and empirically addressed. Although the studies in Chapter 3 and Chapter 4 have discussed the process models at each of their analytical level, questions remain whether the managerial actions employing dynamic capabilities and institutional entrepreneurship would cascade sequentially or rather interactively and holistically. Therefore, adopting the above research approaches to examine the longitudinal process of how organisations coordinate their diverse managerial actions to confer competitive advantage any given point in time could yield value to both streams of literature. On the other hand, the effective integration of the two literature streams would also allow providing a more fine-grained explanation of competitive advantage other than any single perspective that has focused on either firm or environment-centric explanations.

We would also like to clarify that while greater attention shall be directed to the convergence, we are not arguing that the two streams are the only possible theoretical connections. Thus, this paper is limited to the context of emerging fields and only showing the synergies between the two literature streams for the purpose of understanding its strategic behaviour. Admittedly, most of the arguments we have offered in this research note are anecdotal and lack empirical studies to back them up. We achieved our position by questioning whether it makes sense to consider one level of analysis at a time when one tries to understand the dynamics between organisations and emerging fields. We emphasise the full reality that the phenomenon should drive the power of research approaches before any theoretical lens is chosen and research methodology is brought in. Thus, we point out that future research possibilities should lie in a structured representation of the problem setting that organisations are facing with when they make the strategic choice to enter the nascent fields.

Chapter 6

CONCLUSION

"Innovation is defined as the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order. This definition focuses on four basic factors (new ideas, people, transactions, and institutional context)."

– Andrew Van de Ven, 1986: 590

This thesis brought together three papers to address one of the central problems in the management of innovation: how organisations manage innovations related to entering, growing, and succeeding in emerging markets. It explored the paradoxical attributes of firms and showed how stable and dynamic processes are mutually constitutive and occur at multiple levels. Addressing the process problem of developing novel practices into "good currency" (Van de Ven, 1986:591), Chapter 3 developed a conceptual model to understand how organisations develop their capabilities to grow successfully in nascent markets. The paper illustrates *the institutional origins of dynamic capabilities* by introducing and analyzing one set of activities: capability reinforcement. Addressing "a strategic problem of institutional leadership" (Van de Ven, 1986:601), Chapter 4 examined how an organisation combined market-focused and socio-political approaches to establish novel practices in emerging markets. The findings identified the *resource-based origins of institutional entrepreneurship* by introducing and examining a strategic mechanism: boundary infrastructure. The empirical studies were performed independently, but they complement each other and the combined value is greater than the sum of the individual parts. Bridging two theoretical streams, Chapter 5 extended the thesis' contribution by developing an integrative framework which

benefits from appreciating the full spectrum of multi-level consolidation in the field of innovation management.

While the limitations in each study are acknowledged (as presented in each paper), potential research possibilities to extend the work started in this thesis are suggested. In the thesis a rich and multi-faceted case was studied to develop an understanding of and contribute to existing theories from resource-based and institutional perspectives. The unit of analysis in this empirical study was a firm and the level of analysis was at the firm and field levels. Addressing "a human problem of managing attention" (Van de Ven, 1986:590), future studies in the knowledge learning process at the level of an individual could yield theoretical insights to enrich the current story of innovation management in emerging sustainable urban markets. Concurring with the notion that "the individual is always the basic strategic factor of organisation" (Barnard, 1968: 139), future research could look specifically at who inside the organisations acquire what type of knowledge and how this knowledge learning process contributes to individuals' innovative performance. So far I have collected an original registered dataset from Arup including 467 individuals from 16 disciplinary teams who worked on up to 5 integrated sustainable infrastructure development projects over a five-year period. The dataset provides information about individuals including their gender, hierarchical grade in the organisation, group names, and weekly working hours on specific tasks in the projects, etc. The organisation's intranet was used to collect information about the participants' personal knowledge and experiences. Thus, a formal social network containing 467 individuals has been constructed. Adopting the method of social network analysis, my colleagues and I hope to undertake this study in the near future to enhance our understanding of the interactions between social network structure (sparse or dense) and network content (knowledge resource and information). The findings might help to develop our understanding of the internal architectural design of organisation by providing important insights.

This thesis emphasises institutional and market forces as the major contingent influences on organisations' strategic decisions in the process of moving from an established market base to an emerging sustainable urban market. More specifically, these theoretical findings focused on understanding how established organisations embedded in developed economies enter and succeed in an emerging market in emerging economies. Therefore, the barriers presented by market and institutional pressure in a much less developed and also more uncertain environment are one of the main challenges that an established organisation needs to overcome. I suggested that the current rapid transition that many emerging economies are going through offers a rare opportunity for new thinking related to innovation because institutional and business environments vary significantly among different regions (e.g. the western and eastern parts of China are culturally and politically different). Further empirical research on this topic could potentially provide important theoretical insights about the strategic actions and behaviours of organisations entering emerging markets.

Firms based in emerging economies who have been managing their rapid growth and associated challenges in their domestic markets are now at the stage where they are developing capabilities to venture abroad. While few of these firms succeeded in international markets because they were unable to overcome barriers to entry associated with institutional and governance intricacies, some firms have been successful. The study of organisations moving from emerging economies to developed economies raises a promising alternative research agenda with practical and important implications for the shape of the 21st century global business environment (Hoskisson, Hitt et al. 1991, Wright, Filatotchev et al. 2005).

Appendix I – Institutional Context

History of City Planning Profession

Early phases of city development and planning practice

Cities are complex systems which contain physical infrastructures as well as interrelated social and economic components (Jacobs 1961). Since the early existence of urban development dated back to 3000 B.C. in ancient Egypt, cities have evolved dramatically in their forms and functions. Historians classify the long and complex history of city development into five distinct phases including ancient times, Middle Ages, early modern, industrial age and contemporary era (Whitney and Smith 1897, Barraclough and Kellett 1964). Each phase of the development is a reflection of the response to myriad problems associated with human activities at the time. Among them, notable trends in urban development such as Greek cities, Roman style, 'Baroque' principles, industrial cities, garden cities, modernism and post-modernism arise with the challenges of urban growth, social evolution, available technologies and changing climate environment of the time (Bairoch 1991). Although architects, town planners and even policy makers have undertaken the role of planning cities in the old era of city development, it was not until almost one hundred years ago that an organised profession of city planning came into existence (Ellis 2007).

The profession of planning at early days was engaged with responding to rapid urbanization, a result of industrialization in the late nineteenth century. Industrialization led to massive economic and urban growth as countries modernized. The density of industrialized cities increased dramatically as immigrants from rural towns moved to cities in pursuit of work, which led to changes in the social and cultural structures of society. Social and economic classes were separated both in literal location and the benefit they received from industrialization. With the great leapfrog in transportation systems at post-industrialization age, planners were demanded to take considerations of increasingly growing sizes of cities in addition to traditional physical and architectural appreciation, normally termed 'classical town planning'. At the same time, sustainability was raised onto agenda as one of the responses to the ills of the industrial cities. Early urban planners' work such as Frederick Law Olmsted's Central Park in New York City in 1857, Emerald Necklace in Boston in 1878 and many other parks in cities across the United States offered residents a respite from the congested city. The introduction of the Garden City by Ebenezer Howard in his 1898 work Garden Cities of Tomorrow conceptualized cities to be opened up with parks and advocated for dispersing the overly-dense populations of 19th Century industrial cities into satellite towns with ample access to open space and air. The envisioned Garden Cities were proposed

to connect the major urban centres with passenger rail service using one of the primary technologies, which spurred the industrial revolution to assuage many of its consequences. Adopting a similar approach, the Plan of Chicago of 1909 led by Daniel Burnham sought to remedy some of the ills of industrial Chicago. Burnham's plan included broad, tree-lined avenues allowing light and air to enter the otherwise dense city grid. He included an expansive swath of public park space along the city's waterfront to provide the city's residents with access to this great natural asset. Up to this point, professional planners for the first time in history conceptually incorporated sustainability and scale of cities into their design considerations although mainly limited at visionary urban thinking.

From the end of World War II to mid-1970s, planning profession underwent a paradigm shift in response to new urbanization trends in 'de-urbanization' and dramatic social and cultural changes. Technological innovations during post-war period saw both industries and residents leaving in favour of sites on the periphery of the city where modern roadways and railways are available (Bettencourt and West 2010). Industries took advantage of this and moved to the fringe of the city in pursuit of cheaper land. Individuals similarly moved to the periphery of the city drawn by the prospects of home ownership and a modern lifestyle. Thus, planners switched their focus from traditional central city area to new sub-centres. They made urban plans in a broader context of multi-centred urban region - what the geographer Jean Gottman termed "megalopolis". The acceleration of urban change not only incurred changes in physical urban arrangement but resulted in social changes and cultural concerns. For example, a large number of aging mixed-use and residential buildings surrounding the central business skyscraper area in American cities were reputed for emerging social problems involving high crime, low income and deteriorating services. The expanding urban form and changing social context proved planning professions' technical expertise mainly for producing visionary blueprints narrow and insufficient. In response, the visionary city planning approach was more often adopted in conjunction with a more controlled and monitored process including social and political considerations. The evolving face of planning practice demanded planning professionals to enhance the competence of coordinating various interests and achieving comprehensive development objectives. The radical design ideas envisaging urban development had to come along with the rational considerations of urban systems to achieve multi-objectives. Like Olmsted, Howard, and Burnham advocating ecological development for cities, planning principles could be interpreted as a response to industrial cities, but their solutions were dramatically different than those of the previous generation. In the immediate post-war period, planning professions (most notably Le Corbusier) embraced the powers of rational mechanization and believed it could be used to usher in a new era of human prosperity. For instance, urban and regional economic analysis was included as a part of planning practice for the first time (Ellis 2007).

The adoption of the scientific process also inadvertently led to specialization and fragmentation of the city planning profession. Planners were trained to become transportation planners, land use planners, or any other number of specialized disciplines. This limited the ability of the profession to think about the city holistically as a system of interconnected parts. Instead cities were planned according to the needs of its specific parts, but this led to many results that were quickly found to be undesirable. At the same time, planning adopted an approach that was increasingly dictated by the urban elites with little if any citizen participation (Newman 1996, Yeh and Wu 1999).

New visions of urban sustainability and eco-cities

From the late 1970s to mid-1990s, cities faced the challenges of competing no longer in mere regional or national markets, but for survival in a volatile global environment where rules and regulations were rapidly changing. Public awareness of sustainable development had gradually accumulated momentum since threats to the sustainability of the Earth's natural environment and rapid urbanization have brought heavy pressure as well as new opportunities. Therefore, urban development began to be defined by relentless march of urbanization, turbulent global markets and rising environmental problems. Being consistent with the main roles planners played during the post-war period, the planning system evolved towards more rationale-based mode of city planning with limited room for visionary city planning (Ellis 2007). Planners' creative and inspirational ideas were seriously restricted by complex policy process and conflicted interests between private and public sectors. Instead, planners found themselves losing the freedom to make strategic decisions as well as long-term visionary suggestions for urban development. The overall goal of city planning was more regularly intervened by the purpose of protecting widely shared public values including both environmental and social concerns (Hall 2002).

Since mid-1990s, an increasing consensus that sustainability would become the future vision for modern city planning has emerged. Outlined by a six-year study from the Intergovernmental Panel on Climate Change (IPCC) (Change 2007), greenhouse gases, particularly carbon dioxide (CO2) as by-products of industrialization – are responsible for global Climate Change. The World Commission on Environment and Development published the Brundtland Commission Report Our Common Future in 1987 gave sustainability a singular definition, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs". When applying sustainability to cities, the concept resulted in a variety of interpretations but was generally accepted that it should satisfy three basic constituent parts: environmental sustainability, economic sustainability and social-political sustainability (Ruud 2006). According to United Nations, taking the concept of sustainability and relating it to city development would encompass environment, the prosperity and well-being of citizens, and

time. Although the theoretical basis for sustainability at various levels had been recognized and accepted widely, there was a lack of pragmatic demonstrations with feasible solutions to sustainable urban development.

In the contemporary world, Eco-city development is embraced as one of the major responses to the challenges of applying sustainability to city development since it addresses the issues related to both rapid urbanization and climate change. The emerging trend of developing cities sustainably had already begun as early as the 1970s when mission and goals of early environmental advocates started to be publicly accepted. For example, an environmental activist Richard Register founded Urban Ecology, a visionary organisation of architects and activists in 1975. Urban Ecology worked across the disciplines of architecture, city planning, and ecology along with inclusive public participation to generate change at the local level but with a global perspective. Some of the earliest projects focused on reducing automobile traffic to improve the experience for pedestrians and cyclists. Consequently the term 'eco-city' was firstly raised by Register in his book Ecocity Berkeley (1987): Building Cities for a Healthy Future. The book suggests the development of an eco-city provides a radically new form of urban design to adapt to the impact of climate change. It claimed that an eco-city relies on renewable resources, targets to demonstrate a feasible way of sustainable living and low carbon society, and balances environment, equity and economy aspects of the city. Resonating with the idea of applying sustainability to cities, Jan Kunz (2006) echoed the original ideas of ecological cities as 'an environmentally, socially and economically responsible city'. Therefore, eco-city concept, compared to the narrow emphasis on environmental sustainability, offers a more demanding guidance on how to process urban sustainability in a wider context (White 2002). Compared to the traditional urbanization that includes a standardized process of building or assembling infrastructure, eco-city development requests sustainable considerations to be coherently integrated with the existing established practices along the phases of scheduling, budgeting, site safety and logistics. It was a type of urban development heavily supported by multi-parties and governed by particular mechanisms. As Joss (2010) emphasised, developing a sustainable city is actually a complex, dynamic and co-evolutionary innovation process instead of just a simple outcome (Joss 2010).

The demand for developing eco-cities (or sustainable urban development) posed serious challenges and triggered another paradigm shift at the conceptual and practical level of city planning. Previously the requirement of adopting scientific processes in modern city planning era inadvertently led to the specialization and fragmentation of the city planning profession. Planners were trained to become transportation planners, land use planners, and some other professionals of specialized disciplines. However, the eco-city planning, used as a single framework covering many inspirational but disconnected ideas, requires planners to arrange

the city as a system of interconnected parts, which planners found particularly difficult to achieve based on their own specialized knowledge and limited experiences. In that sense, the emergence of the eco-city concept urged planning profession to reconsider their roles in the wide context of urban development. Moreover, the challenges confronting planners became more significant since the eco-city concept only offered theoretical guidance rather than pragmatic solutions due to its significant shortage in real demonstrations as well as standardization and clarification (Abbott 1988). By 2000, planners have tried to illustrate some components of the holistic eco-city development (i.e. BedZED project in UK), they have yet to synthesize all the disparate components together to put the theoretical ‘eco-cities’ into reality (Roseland 2001).

Appendix II – Empirical Context

Arup's Dongtan Project and its Eco-city Business

The case report was written without a pre-determined question (Glaser & Strauss, 1967) but with an interest in a whole story of Arup's involvement in the world's first eco-city project. The report reviews the founding, history, values and vision of the firm Arup and details the story of the Dongtan eco-city development. Embedded in the empirical context of a rapid changing built environment, the report presents the antecedent, processes and consequences of Arup's involvement in the Dongtan eco-city project and how that formed the trajectory of Arup's eco-city business.

The Organisation – Arup

What does Arup do?

Arup was established in 1946 its initial focus being on structural engineering, but it was the delivery of structural design for the Sydney Opera House that first drew the world's attention. Also putting its name on the well-known Centre Pompidou project in Paris, Arup has since grown into a truly multidisciplinary organisation with designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Now the company has over 10,000 staff working in more than 90 offices in 37 countries organised into five regions, the Americas, Australasia, East Asia, Europe and the UK, Middle East and Africa (UK-MEA). Arup's corporate centre is based in the UK. [8]

At any given time, Arup has over 10,000 projects running. Its often innovative and multi-disciplinary approach and client focus philosophy enable the firm to enjoy the freedom to involve people from any or all of the sectors or regions on any design problem. Arup exert a significant influence in the built environment given the credit from their achievements in numerous prestigious projects such as the Sydney Opera House in Australia, Channel Tunnel Rail Link (France-UK), Millennium Bridge in UK and recent works for the 2008 Olympics in Beijing. The identity of innovative and sustainable design enabled the firm to become one of the most attractive places for professionals in the field to work.

Arup's core values and objectives

Arup aims to shape a better world to enhance prosperity and the quality of life, to deliver real value, and to have the freedom to be creative and to learn.[9] Arup's core values are envisioned

8 http://www.arup.com/About_us.aspx

9 Key Speech, Sir Ove Arup, 9 July 1970

by Sir Ove Arup (1895-1988): 1) Ensure that the Arup name is always associated with quality; 2) Act honestly and fairly in dealings with our staff and others; 3) Enhance prosperity for all Arup staff. [10] There are four core objectives raised as priorities in Arup's work: 1) clients and industry; 2) creativity; 3) people; 4) sustainable development.[11]

Arup's ownership and management structure

Arup is owned by a trust, funded by Arup employees. [12] The independent ownership structure enables the firm to make decisions on behalf of its own people, alongside the needs of clients and commercial imperatives. With no shareholders or external investors, Arup is able to determine its own direction as a business and set its own priorities, with less pressure on the need to return investment immediately. "*Our investment view is longer term. We're a trust and not a public company. We take a seven to ten-year view on payback,*" says Jeremy Watson, Arup's global research director.

Arup's management structure is designed to support innovation, and management is decentralized to encourage creativity. It is seen as an organisation that prides itself *"in taking on challenges that a lot of other people wouldn't want to take on."* [13]

Arup's vision of future cities

Arup considers that shaping a sustainable future – particularly for the urban environment – will be one of the greatest challenges in the 21st century. Both the creation of new cities from the ground up, as is often the case in developing countries, and retrofitting existing urban centers in developed countries for a low carbon future, require harmonization with natural surroundings and biodiversity.

Sustainability at the heart of urban development is what Arup proposes for future cities. Arup insists that its sustainability policy "promotion of economic security, social betterment and environmental stewardship" will be implemented in practice. The director of the Planning Group Peter Head asserted, "*in order to respond to the drivers that are changing our planet and the way we live upon it, we must enter an ecological age – a sustainable way of living where the global economy is in harmony with the size of the eco-system that supports it.*" Arup believes that businesses are an essential part of the move to an ecological age and the company is already benefiting from the opportunities that this transition is creating.

10 Key Speech, Sir Ove Arup, 9 July 1970

11 Key Speech, Sir Ove Arup, 9 July 1970

12 Arup Corporate Report, 2010

13 Interview with Prof. David Gann, Head of Innovation and Entrepreneurship group, Imperial College Business School

Dongtan Eco-city Development

Project brief

The Dongtan project was initiated in the light of the P.R. China's five-year plan[14] (2006–2010) which was based on the guiding principle of 'sustainable development'. In 2005 the president of China, Hu Jintao, told the People's Congress that "*China has to overcome the problems of environmental pollution and resource depletion*", adding that current development trends were 'environmentally unsustainable'. Such bold initiatives from central government, which Dongtan aim align with, are particularly influential and important in China.[15]

Initiated as an experiment to create a carbon-neutral city from scratch and prototype for the future of all cities in China, the Dongtan project focuses on ambitious goals to deliver long-term ecological sustainability as well as economic vitality and prosperity. The new eco-city would be located in sensitive wetlands on Chongming Island at the mouth of the Yangtze River, just north of Shanghai. Its first phase, a marina village of 20,000 inhabitants, targeted to be unveiled at the 2010 World Expo in Shanghai. The plan for 2020 is that nearly 80,000 people will inhabit the city's environmentally sustainable neighborhoods and half a million by 2050. The Dongtan project planned 630 hectares, roughly three times the size of the City of London, included a transport hub and port to accommodate fast ferries from the mainland and the new Shanghai airport, a leisure facility, an education complex, space for high-tech industry and housing etc. Two major goals of the project were to generate zero carbon emissions and cut average energy demands by two thirds via a unique city layout, energy infrastructure and building design. (Figure A.1)

Figure A.1 Vision of Dongtan, Courtesy of Arup (Source: Arup)

14 The five-year plan of China is a series of economic development initiatives.

15 Geoff Dyer, *China to 'pioneer first sustainable city'*, Financial Times Sept. 15, 2006

In 2005, former British Prime Minister Tony Blair and Chinese President Hu Jintao signed a contractual agreement to develop the world's first "eco-city" Dongtan and have more sustainable project collaboration in the future. Shanghai Industrial Investment Corporation (SIIC), a state-run pharmaceutical and real estate investment firm first hired McKinsey & Company for the project. Taking the recommendation of McKinsey, SIIC employed London-based Arup to take the lead design role in the Dongtan eco-city development. Later on, SIIC and Arup signed partnership agreements with HSBC and the UK investment bank Sustainable Development Capital LLP (SDCL) to co-deliver the project.

Arup formed a strategic partnership with SIIC and was commissioned to provide a full range of planning services for the Dongtan project, including urban design, planning, sustainable energy management, waste management, renewable energy process implementation, economic and business planning, sustainable building design, architecture, infrastructure and planning of communities and social structures.[16] Arup and SIIC also signed a memorandum of understanding (MOU) with the University of East Anglia carbon reduction team in the UK to co-work on the Dongtan Sustainable Technologies and Renewable (STAR) project. Other collaborating firms include construction company Davis Langdon, environmental development firm Eco-Energy Cities, Monitor Group, and the Climate Group etc.

Echoing SIIC's ambition "to skip traditional industrialization in favor of ecological modernism", the SIIC-Arup relationship developed from the traditional client–consultant relationship into a major framework to achieve sustainable development for the whole of China including the Tangye New Town master plan (2005), Wanzhuang conceptual planning (2006), Zhujia Jiao integrated planning (2007), and Huzhou conceptual plan (2007) etc., in addition to the Dongtan project.

The Dongtan project also provided an unsurpassed opportunity to theoretically capture all aspects of the eco-city development during the consultation, planning and design stages as well as the implementation phases. A jointly organised EPSRC/Arup workshop (Nov 2006) resulted in the formation of EPSRC Dongtan research networks to allow UK researchers such as Imperial College London, University College London and Southampton University to collaborate with Chinese researchers and jointly submit research proposals to appropriate

16 Green Progress, "Arup and SIIC sign accord to develop further sustainable cities in China," Nov. 9, 2005, http://www.greenprogress.com/green_building_article.php?id=579.

funding bodies. In order to support this research network, Arup provided project information, technical expertise and administrative services.[17]

Dongtan became a city of dreams

In a country overloaded with environmental challenges, Dongtan became a symbol of political ambition and vision that spanned China and Britain. Unfortunately, the Dongtan project failed in the first instance in realizing that bold vision off the drawing boards, and fell short of implementation.[18] Much of the media attributed the sinking of the Dongtan project to the arrest of Mr Liangyu Chen in 2006, former Shanghai mayor and the project's major champion, for property-related fraud. However, the rationale behind the stalling of the project was supported by more complicated factors which we hereby address as below.

Vision discrepancy between Central government and Shanghai government

The proposed Dongtan eco-city development master plan fitted the aspirations of client Shanghai Industrial Investment Cooperation (SIIC). SIIC is a semi state-owned developer acting on behalf of the Shanghai government in the Dongtan project. Chenliang Ma, the president of SIIC, raised the level of political support and publicity by involving UK and Chinese central governments as well as a host of UK groups. In 2005 during President Jintao Hu's state visit to London, the then-Prime Minister Tony Blair hailed Dongtan as a symbol of British-Chinese cooperation. His successor Gordon Brown continued to promote the project in February 2008, framing it as a model for future British eco-towns.

On the other hand, other voices from the Chinese central government did not favor SIIC's proposed framework. They did not like the idea of Dongtan being developed separately from the whole Chongming Island. The political support dwindled after the arrest of former Shanghai mayor. Even though SIIC had acquired the ownership of the Dongtan land a long time ago, SIIC failed to get the China Construction Bureau's approval to the development plan proposed and designed by Arup.

17http://www.epsrc.ac.uk/ourportfolio/themes/engineering/introduction/sue/Pages/Dongtanresearchnetworks.aspx

18 Christina Larson, *China's grand plans for eco cities lie abandoned*, 2009

At the post-Dongtan design stage, SIIC agreed to co-operate with the local authorities to develop the whole of Chongming (including the Dongtan area) into an agriculture-based island including both residential and industrial development.[19]

Political scandal made the Dongtan project toxic for followers

Before the political scandal, the Shanghai government fully backed the Dongtan project and was keen to promote it to visitors. However, since the project's political champion in the local Communist party had been imprisoned after a major corruption trial, the successors saw the project as a toxic remnant. Nobody wanted to revitalize a project that was initiated by disgraced former politicians.[20]

Design unsuited for the needs of local residents and building procedures

In the course of the Dongtan design process, renowned foreign architectural and engineering firms struggled to design an appropriate urban plan from scratch because of their limited knowledge of local politics, culture, and socio-economic development. In addition, miscommunication between international firms and local developers largely impeded the design process.[21]

The proposed planning did not fully account for the needs of local residents and thus failed to make the Dongtan project convincing enough. Lacking community considerations, no one could effectively ensure the paper design could be smoothly transformed into reality.

Speculation about funding and environmental challenges

The area adjacent to Dongtan included natural wetlands and bird habitats. Environmentalists have never liked the idea of developing an urban city close to natural wetlands. Moreover, there was an unfounded rumor that the sustainability element of the Dongtan project was strategically added by SIIC. The rumor speculated that SIIC purposefully set up Dongtan's sustainability objective in order to speed up and facilitate the process of gaining planning permission.

Dongtan project set up a design model for eco-city development

Since the first step on Dongtan, eco-city related projects have generated impressive goodwill in and outside of Arup, yielding not only considerable income, but also provided significant

19 Interview with Guihua Gao, SIIC, May 2010

20 http://www.ethicalcorp.com/content.asp?ContentID=6314

21 http://www.feer.com/international-relations/20098/may56/Building-a-Greener-China

rewards to the firm in terms of reputation, knowledge development and experience in a nascent market. Looking back on the past five years of engaging in eco-city business, we condense Arup's learning from the Dongtan project into four stages.[22]

Stage 1: In the first year after Arup agreed to undertake the Dongtan project (2005), it learnt the importance of integrating the element of life style, also called cultural background, into the project. Arup established a new functional position 'cultural planning' and integrated it into the multi-disciplinary project team. This functional element has been redeployed and replicated in a couple of later projects.

Stage 2: In the second year (2006), Arup realised that a detailed economic analysis was crucial as a part of their novel design approach. In order to understand the economic aspects of the project, CBRE, the world's leading commercial real estate advisor, was appointed to investigate and estimate the real estate growth in Dongtan in the near future.

Stage 3: In the third year (2007), Arup acknowledged that attracting business investments was key to ensuring the success of any eco-city master plan. Compared to the sound business plan highlighted in the Wanzhuang project (2006-2009), Dongtan did not have a real business plan at that stage.

Stage 4: In the fourth year (2008), the Dongtan project was postponed. Arup identified capital risk as another key element in sustainable urban development projects. The hard-core question vis-à-vis clients were to demonstrate how to win all the capital and mitigate the capital risks. Overseas institutes/organisations can make great suggestions but it is hard to make local impact.

Summing up the above, we found that traditionally the problems associated with urban growth and global sustainability was treated as independent issues, i.e. over-emphasizing technical solutions. The Dongtan project offered Arup an opportunity to practically integrate the multiple inter-dependent elements needed for new sustainable urban development. Arup asserted that sustainability should be considered and defined as a socio-political problem with technical attributes, instead of a rounded technical solution with socio-political implications.

22 Shanfeng Dong, Zhou Zheng, Yijiang Wu et. al., Navigating the Eco-city, Sept. 2010

Arup's Eco-city Business (2000 – 2010)

Antecedent – Arup's urban planning practices at the pre-Dongtan stage (2000 – 2004)

During the period from 2000 to 2004, Arup, an elite player specialized in engineering services, had a relatively smaller team in urban planning. The urban planners' responsibility was to formulate a long-term vision, plans for land use and infrastructure, and produce a collection of detailed ways to describe a wide array of considerations such as residential, recreational and commercial issues. Traditionally urban planning adopts a linear process seeing clients firstly employing a consultant to provide a business plan for land use and real estate consultants, being called in later to estimate land value and forecast potential market return. In such a linear process, urban planners will get on board after business and real estate consultants fitting their urban plans into the proposed business framework. The decisions/assumptions urban planners make are normally based on existing industrial regulations and rules. Engineers will finally come in to assess the feasibility of the proposed master plan and ensure the provision of basic infrastructures. Urban planners will collaborate with engineers to adjust and finalize the plan. In the past, traditional planning projects have seldom placed sustainability at the centre of proposals. Urban planners typically simplified the planning problem to quantifiable issues or sometimes even ignored the whole issue of sustainability at the planning stage. The traditional linear planning process would not suffice when projects request a high level sustainable outcome. This was because tasks would become much more complex if a broad range of inter-related topics contributing to the same sustainability objective were added.

For Arup, one of the most famous sustainable urban development projects before Dongtan Eco-city was the BedZED development (For project details, see Appendix A). Arup collaborated closely with the project architect Bill Dunster to validate and improve their design ideas. Their purpose was to balance the social and financial aspects of the land use along with ecological impact and resource consumption. Arup demonstrated their knowledge and experience of generating a sustainable model for living through delivering the entire lifecycle of the project: from construction to occupation and use.

Chris Twinn, Director of Arup's Building Engineering Sustainability Group was the leading engineer on the BedZED project. He described Arup's energy work in the BedZED project:

> *"BedZED, a whole raft of other zero carbon developments that we've been doing in one form or another, so there was, and demand reduction developments we've been doing, then analyzing energy of the real buildings when we can get at it - which has been very rarely; continual input in to policy and whatever, making it clear where that knowledge is."*

He indicated that in the past Arup had learnt a lot about sustainable building design but never systematically integrated the new knowledge and applied it on a large scale. In the BedZED project, Arup was appointed as the design engineer but was not asked to integrate the separate design parts of the whole urban system. Arup didn't take the responsibility of strategically overseeing the whole project either.

Although BedZED did not raise as many challenges as Dongtan due to its comparably smaller scale and scope, the BedZED involvement did provide Arup with valuable knowledge and experience before they embarked on the Dongtan project later on. [23]

Process – Arup's involvement in the Dongtan project (2004 – 2008)

Longitudinal process studies are shown to be fundamental in the appreciation of dynamic organisational life. Through the observation of a discrete set of events, the following study helps to unpack the underlying mechanisms which link to our concepts and the observed events (Table A.1). [24]

Phase	Approximate Time	Description	Key Challenges
Optioneering	2000 – April 2004	SIIC set up the framework for idea competition in 2000. Three options were shortlisted but none of them were approved by SIIC.	Four well known international firms were invited to propose urban plans for the Dongtan area but none of the options was localized and tested for feasibility.
Idea Generation	April 2004 – December 2004	McKinsey recommended that Arup join the project. The client was satisfied with Arup's initial study findings.	No existing Eco-city template for the client SIIC and no benchmark design to refer to for Arup. Ambiguous settings of the project. Arup had very limited knowledge of local culture, economics and politics.
Contract Negotiation	January 2005 – August 2005	In these eight months Arup negotiated with the client to sign the contract which would authorize them to provide the master planning services for the first phase of the Dongtan project.	Arup were heavily challenged by the requirement of providing integrated multi-disciplinary services for the project.
Integrated Sustainable Master Planning	August 2005 – late 2008	Arup adopted an innovative design approach – 'negotiated urbanism' also called integrated sustainable design method to deliver the project. They created a new business unit– integrated urbanism to adopt the new	The project required collective ideas from all disciplines to form design decisions simultaneously. It was the challenge of designing a large scale urban system to align the new criteria of sustainability with all other technical,

23 Interview with Chris Twinn.

24 Van de Ven, A. H., & Huber, G. P. 1990. *Longitudinal field research methods for studying processes of organisational change.* Organisation Science, 1(3): 213-219.

		approach. In October 2005, Arup submitted the Interim Report One. In December 2005, Arup generated Final Report One and the report was approved in January 2006. From January to June 2006, Arup was working on the control plan. In August 2006, the consulting fee was settled between SIIC and Arup. In October 2006, Arup issued sustainable guidelines for the Dongtan project. From January to October 2007, Arup was engaged in three work teams including 1) infrastructure; 2) phase plan for 80,000 residents; 3) next two-year and five-year plan for Dongtan In 2008, Arup produced four volumes of basic guidelines. Later in the same year, the Dongtan project was officially halted	social and economic aspects
Further improvement in the subsequent projects	2008 – 2010	Arup was deeply involved in influencing the macro discourse by demonstrating the viable solution and envision the future of an ecological age. At the post-Dongtan stage, Arup were awarded several similar projects including Tangye, Wanzhuang, Huzhou, Zhujiajiao eco-city projects etc.	The challenges of making institutional impact on the external environment and legitimizing Arup's innovative design capabilities in the emerging eco-city market.

Table A.1 Dongtan Project Lifecycle

Taking the project on board

In 2000, Shanghai Industrial Investment Corporation (SIIC) decided to commission a series of ecological studies on how to develop the Dongtan area on Chongming Island into an economically and environmentally sustainable zone. SIIC invited Philip Johnson, London-based Atkins and Paris-based Architecture Studio, all considered as giants in the architecture world, to create master plans for Dongtan.[25] Academic institutions such as Tongji University were invited to help the firms localise their design ideas in China. Tongji University provided local input to help Atkins and Architecture Studio generate ideas and initiate their design

25 Wired Magazine: Issue 15.05 Pop-Up Cities: *China Builds a Bright Green Metropolis*

frameworks[26]. In 2004, four years after SIIC launched the design competition for land use, three ideas were shortlisted and a Japanese consultant was hired to integrate them. However, SIIC found none of the proposals feasible. McKinsey was then hired to work on a strategic proposal of economic growth in Dongtan. They found themselves incapable of providing professional engineering services and recommended that Arup join the project. When the project entered the engineering phase, McKinsey left the Dongtan project and SIIC appointed Arup as the main project deliverer. This transformation left Arup effectively running the project, a role that Arup had seldom played, especially in the context of a large greenfield development project. Faced with unprecedented challenges, Arup also found themselves in a position to experiment and drive the project in the direction of the underlying vision of the 'Arup way'. McKinsey's departure enabled Arup to take on a much more central role as well as gaining opportunities to acquire new skills and test new approaches.

Development of the first project team

In April 2004, Arup reviewed previous shortlisted design ideas but found none of them tested against feasibility criteria. All three proposed master plans were simply ecological approaches without considering other key factors underpinning sustainability such as political, legal and economic issues. In May, a small Arup group including Roger Wood[27], Alejandro Gutierrez, Shanfeng Dong, an environment expert from the Newcastle office, a pair of economists (e.g. Elaine Trimble and Nicola White), several urban designers and an ornithologist became Arup's first Dongtan project team. Shanfeng Dong and Alejandro Gutierrez knew each other from their MSc in City Design and Social Science education at London School of Economics and Political Science in 1998. [28] Alejandro Gutierrez approached Shanfeng Dong since he had gained valuable local experience of working in design institutes and developers since graduation.[29] After several meetings, Arup finished the initial urban development proposal in three months. The proposal included a plan for how the Dongtan urban area could productively interact with the nearby bird sanctuary and how the ecological conditions of Chongming Island could be promoted. SIIC wanted Arup to further develop alternatives to the previous three proposals, which would focus on developing an

26 Interview with Dajian Zhu, Professor, School of Economics and Management, Tongji University; Head of Department of Public Management, Tongji University; Director, Institute of Governance for Sustainable Development, Tongji University.

27 Roger Wood was involved in setting the commercial deal at that stage.

28 Interview with Alejandro Gutierrez.

29 Interview with Shanfeng Dong.

actual brief for the urban project. The work was composed of building the idea, character, and the capacity of what would be feasible for a possible first phase of a sustainable Dongtan. [30]

Challenges and risks

Malcolm Smith, director of the Urban Design London group, discussed the unprecedented challenges of balancing ecological aspirations and practical risks. He suggested that the world's first eco-city project faced the problem of many undefined and non-existent work practices for Arup to clarify. Being occupied with the creative thinking to produce a unique plan, Arup also needed to put the reality of risks, finances, skills and locations into their design considerations. Furthermore, Arup had to coordinate different industry parameters into their design product. They liaised with Chinese local authorities and collaborated with different local actors to set up their design parameters. [31] In addition, SIIC was a local, experienced real estate developer but lacked the experience of managing concessions of a greenfield urban design and bringing them to financial closure.

Proposing economic models and funding strategies

In the first master planning draft, McKinsey proposed to build Dongtan as a business service centre acting as a functional back office to support Shanghai's booming business activities. Elaine Trimble, a senior economist at Arup reviewed McKinsey's model and changed the economic proposal to develop Dongtan into an R&D hub for green technologies.

In November 2004, Peter Head, former chief executive of Faber Maunsell, also a prominent member of the London Sustainable Development Commission and 'green guru' for London's Olympic Construction task force, was appointed as the global director of Arup's planning group. After hiring Peter, Arup proposed to create an economic and sustainable zone, with policies, housing, transport, education aligned and designed to benefit the green business within the zone (i.e. a lower corporate tax rate and speedier process of permits). The proposal of the economic and sustainable zone predicted a clustering effect based on gathering global green tech firms, and expected them would largely help to establish a viable city. Tying the economic initiatives (green technologies) with the other aspects of the development in the economic zone, was thus considered a crucial step for the Dongtan project. The next step was to work out the internal economic generators for the city, which required Arup to make sure the economic generators fit with the other design factors: labor market, health, and housing etc. Nevertheless, due to the difficulties of obtaining local data, Elaine struggled to feed accurate, quantified data into her economic model. Arup became confused about how much support they could get from local authorities to propose the economic model. Our

30 Interview with Braulio Eduardo Morera.

31 Interview with Malcolm Smith.

interviewees frequently highlighted this difficulty and as John Roberts, the Director of Energy Strategy London group in Arup explained,

> *"the project was going nowhere basically and the client was talking about implementation … some of the supply chain issues I couldn't address, because I couldn't talk to the authorities, because our client wouldn't let us, you know?"*

The idea of establishing a viable economic model kept evolving. Arup tried to uncover the possibility of integrating green R&D labs with a place for specialized education. Jonathan Maxwell from HSBC approached Arup with a set of infrastructure investment funds. He considered the Dongtan project as a green field opportunity but also a high and multi-risk project. As a banker, Jonathan Maxwell suggested that Arup economically and financially de-risk the project as much as possible. Having addressed that, he argued that facilitating local education would be the main economic driver for the Dongtan area. He detailed his proposal by formulating a strategy on how the education-driven urban development would be founded on a specific world-class institution. Three potential modes were proposed for the education institution: 1) Establishing a world-class research institution to build up local capacity in Dongtan; Jonathan recommended the Weitzman Institute of Science in Israel [32] as the benchmark, 2) building a carbon stock exchange centre, and 3) developing an education centre attracting several universities. In the same period, Peter Head brought strategic values into the project. He raised the possibility of delivering a demonstration project which would present the latest technology from a sustainability perspective. He recommended the establishment of an institute for sustainability as a hub of green technologies to be supported by multiple research and development units.

Economic models provided guidelines as to how much value developers can generate from various areas of the development activities, i.e. asset management and green technologies. Through the dynamic process of exploring solutions on Dongtan's economic development, Arup made a few proposals with a view to detailing the solutions in the next phase of the project when more accurate data would be available.[33]

Alongside the work of creating a viable economic model for Dongtan, there was also a long spell of funding strategy turbulence between SIIC and Arup. The client initially expected Arup to bring in investment parties, but after the project became more politically sensitive and public, the Chinese government[34] decided they would no longer need external investment

32 The Weitzman Institute is a multi-disciplinary scientific research institute which took 30 years to cluster 180 companies around the institute area and make profit.

33 Interview with Elaine Trimble.

34 Podcast: Interview with Paul French - Dongtan China's eco-potemkin village and Arup's political connections.

and the project should be fully funded by Chinese investors. This decision frustrated Arup since SIIC partially refused to disclose their funding strategies for the project. The only assurance Elaine Trimble got was that there would be money for the project, although it was never clear how the client's financial teams would work. Arup's frustration caused by the challenges of working with the Chinese client can be easily illustrated by quotes from our interviewees

> *"Now where the business, where my frustration was that to this day no one can tell me how much it's going to cost, and I always got the highest numbers … you (need to) tell me why, and how much more it's going to be and why we should do it this way and not something else."*

Another associate director in operations, also considered the Chinese client was pretty much hands-off in the project. Arup could get very limited input from local authorities, and the assumptions in the design (i.e. logistics) were mainly based on information of western consumption. Arup gradually learnt to engage Chinese local design institutes – otherwise they would not be able to come up with any relevant design.

The birth of the Planning and Integrated Urbanism Business Unit

The Planning and Integrated Urbanism Business Unit was born as a result of a number of simultaneous occurrences. Firstly, Roger Wood was working on the urban renaissance report in the topic of the future of cities; secondly, Arup Associates, composed of integrated disciplinary teams, were working on the Stratford City redevelopment project revolving around sustainability; and thirdly, Chris Twinn[35] had just finished the BedZED project. He found that people were working in similar fields but with no useful exchange of information. Chris Twinn was looking for an integrated and natural way of designing sustainable buildings; however, this initiative attracted little interest or funding at Arup. Combining these initiatives paved the way for an innovative integrated approach to tackle sustainability-related projects. Just as Andre Luque, a senior architect and urban designer, said in an interview,

> *"There's also something about the Arup ethos, the way Arup has been working for the last 60 years that has been there all the time that makes it easier for us to develop that system".*

Furthermore, Volker Buscher, the director of IT and business consultancy at Arup, added,

> *"Integrated urbanism …is a vision that has materialized in the last few years in Arups, and certainly with Peter Head joining us as a catalyst to give it a final*

35 In 1999, Chris Twinn, current Director of the Building Engineering Sustainability Group in Arup, became involved in the BedZED project (Beddington Zero Energy Development).

consolidation around things that Alejandro Gutierrez and Malcolm Smith and other people have done over the years."

Arup recognized that traditional engineering management systems (normally adopted from their infrastructure business unit) were not capable of coping with the new challenges of planning an eco-city. This is because conventional planning processes tend to focus on one issue at a time – a stop-and-go process – and too often the impact of one system on another system or property is ignored until the consequence becomes a reality.[36] In other words, traditional planning by default defines *urban design* as the whole basis of design with technical strategies coming in and following the basis at a later stage. Sustainable master planning requires amalgamation of both urban design and technical strategies generating optimum output of an urban design product with sound technical solutions. Integration of the whole instead of a simple sum of the parts is crucial. [37] [38]

Building on the various camps of initiatives, the Integrated Urbanism Business Unit, initially named as Urban Places 5, was established as an independent team consisting of key disciplines including transport, energy, waste, information systems, socio-economics, microclimate and ecology. In practice, the spirit of the new 'integrated urbanism' unit showed that the key to planning a city from scratch was to establish long-term sustainability satisfying all social, economic and environmental aspects. Specialists from different technical backgrounds had to collaborate very closely because the results of any technical analysis would be the assumptions for others. Since the product of a master plan had to meet different criteria covering urban design, planning, sustainable energy management, waste management, renewable energy process implementation, economic and business planning, sustainable building design, architecture, and infrastructure and planning of communities and social structures, an intensively integrated approach to a project like Dongtan became a necessity. Integrated Urbanism began with only three members and swelled to 60 by mid-2008.[39] [40] Roger Wood, director of Integrated Urbanism, stated that Arup

"started to sort of influence people in Australia and America and other parts of Arup", "(Roger)… with Alejandro Gutierrez and Malcolm Smith, building this network around the world now, of like-minded people, but (they) can only do a finite number of projects at any one time."

36 Head and Lawrence, 2008.

37 Interview with David Briggs.

38 Interview with Neil Grange & Romano?

39 Interview with Malcolm Smith.

40 Interview with Roger Wood.

Braulio Morera, a senior architect on the Dongtan project, asserted it was Arup's integrated design approach that brought novel ideas to the planning proposal, which the Chinese client favoured a lot.

> *"What happened is that our client had several, like, two or three master plans before, and all of those master plans were quite conventional. So the client wasn't very happy about it. And the difference that Arup made is that the main theme for us was to test alternatives, to generate urban development to interact with the bird sanctuary. And with the ecological conditions of Chongming Island. So that part of the study took three months. That was presented during, at the end of 2004, beginning of 2005."*

At the end of 2004, Arup submitted and presented their findings of the initial study to the client. SIIC preferred Arup's ideas and spent the period from early to August 2005 on contract negotiations with Arup. Peter Head was actively involved in the negotiation process. In August 2005, Arup signed the contract to provide professional services for the first phase of the Dongtan project. The services included urban design, planning, sustainable energy management, waste management, renewable energy process implementation, economic and business planning, sustainable building design, architecture, infrastructure and planning of communities and social structures. Arup carried out the first integrated sustainability workshop after the contract was agreed. The workshop engaged external and internal specialists to understand the overall picture of the project and express their views on the context and potential output of the project. Workshop participants included specialists from Arup London and Shanghai offices, Chongming government, local design institutes, Shanghai government and Tongji University.[41] After the first workshop, Braulio Morera recalled that Arup had weekly meetings with everyone and weekly specific meetings with each of the disciplines.

In Oct 2005, Arup delivered the Interim Report One which focused on how ideas could come together to generate a physical proposal with an urban image. There were about 30 people in the whole project team at that time.[42] Arup proposed that Dongtan be divided into three development phases, each one adding a new, mixed-use neighbourhood complete with condos, offices, and retail space all sprouting at once. Alejandro Gutierrez designed each neighbourhood with two downtowns: one at the centre, modest and intimate, within easy walking distance from homes and offices, and one at the edge. The three at the edges would overlap and gradually grow into metropolitan Dongtan. *"Our worst-case scenario is that Dongtan starts out as a tourism-based settlement,"* Alejandro explained, *"but grows over*

41 Interview with Braulio Eduardo Morera.

42 Interview with Braulio Eduardo Morera.

time to include other industries." Best-case scenario: *"China's huge market for renewable energy and Dongtan's bright-green reputation persuade clean technology firms to set up labs and commercial outposts in the city."*[43] In December 2005, Arup generated Final Report One based on Interim Report One. In this report, Arup associated their proposed ideas/strategies in Interim Report One with feasible technologies and solutions. Arup got the report approved in January 2006.[44]

From early to June 2006, Arup was engaged in delivering the control plan for Dongtan, this being a planning application document to be submitted to local development authorities. Local design institutes generate the final planning application documents based on the control plan and submit the plan to the local government. The control plan for Dongtan was approved in September 2006,[45] and Arup's various disciplinary offices at different geographic locations collaborated to deliver it. Water, flood and geotechnical engineering works were done at the Hong Kong office, whilst transport planning, freight and logistics, information, waste materials, quality noise, agriculture, social infrastructure, urban design, open space and landscape works were finished at Arup's London-based offices. Energy work was shared by the London and Hong Kong offices. However, David Brigg, associate director of Operations at Arup, commented that Arup was relatively inexperienced in delivering control plans, indicating that there were different completion levels across different sections of the control plan that Arup delivered.[46]

Innovative design philosophy and methodology

In the course of the project, Arup adopted a new philosophy guiding their design process. The new philosophy called 'negotiated urbanism' or 'serial innovation' was raised by the project director Peter Head for the purpose of transforming the traditional master planning idea into a new concept adaptable to eco-city projects. The new philosophy required organisations to change from the usual architectural design approach to a 'negotiated urbanism' approach. The traditional architectural approach sees a single or a few chief architects dominating the design process, i.e. instructing others to execute their ideas. 'Negotiated urbanism' dissociates itself from the kind of egocentric, heroic individual who creates a great vision. The task of designing the Dongtan eco-city called for collective ideas from all disciplines to form design decisions. The challenge lay in designing a comprehensive end-to-end system to align sustainability criteria with new urban systems instead of relying on any single disciplinary input.

43 Wire Magazine: Issue 15.05 Pop-Up Cities: *China Builds a Bright Green Metropolis*.

44 Interview with Braulio Eduardo Morera.

45 Interview with Braulio Eduardo Morera.

46 Interview with David Briggs.

Concurrent with the design process of the Dongtan master plan, Arup created a digital modelling system called 'Integrated Resource Model' (IRM) which quantified how well a proposed design performed relative to already proposed units, systems and interfaces in an easily comprehensive manner.[47] Since all the input from different disciplines was closely interwoven and dependent on each other, the digital modelling system enabled this dynamic inflow to hum after several iterations, called 'virtual cycles' by some of our interviewees. Each discipline working in the virtual cycles could operate in a much lighter way because they were actually solving each other's problems. [48] The digital tool largely helped the integrated design teams to set up and monitor the planning process on the same baseline without compromising any disciplinary input. It optimized diverse information flows to work coherently and simultaneously. The digital modelling framework was not just a simple tool that provided a platform for capturing sustainable performance but actually informed and influenced Arup's decision-making process in the Dongtan project. Nevertheless, Chris Twinn, director of the building engineering sustainable group, pointed out the limitations of the IRM model,

> *"because the model has started to get so complicated, because the inputs they require, you're only at the end of the process, it is very difficult to make it an easy iterative to use. So a challenge shall we say. And my feeling is … we won't be able to use the IRM model on commercial projects or the energy project because of the time involved."*

The key purpose of the integrated sustainable urban design tool was about sanity check, and aiding the decision-making process in master planning. Contradictory to the traditional planning process which took architectural or urban planning as the centre of the design criteria, integrated design methodology dealt with supply and demand between quantities. Therefore, the design tool didn't have a spatial element in its model.

Peter Head, director of Arup planning, gave an example of virtual cycle practice,

> *"one example is linking transport quality, health, value, development value, return on investment which is the compact mixed use development scenario … close together that means they don't jump in a car, that means you don't get the emissions into the air, that means you get better health, better environmental quality, so a more attractive place to live, so a more desirable place; therefore the developer gets a high return on capital, and actually all of that supports that...the understanding of density in relation to public transport that if you*

47 Interview with Alejandro Gutierrez.

48 Interview with Peter Head.

have a certain level of density and vibrancy then public transport can be supported commercially."

Roger Wood also gave an example for the energy design using IRM,

> *"if there's a series of systems that give outputs, then those outputs can be put into the IRM, and what the IRM allows a developer to do, is change his land use, and see the impacts on the KPIs that he's chosen, as you change the land use, and as it becomes more refined… but there are then other decisions you make, like you could start off with just taking electricity from coal fired power stations, and you can see your impact on CO2 emissions. And then perhaps an opportunity comes to use wind energy, or to use bio-mass, that immediately has an impact on your CO2 emissions, but it needs the data to know how much energy it has to generate, which comes from the population, which comes from the land use, and all of this sort of thing, so that's why it's important."*

In August 2006, the iterative process of negotiating the deal between SIIC and Arup came to an end. The total consulting fee was settled in the order of £350,000 which was about two and a half times the normal cost.[49] SIIC approved Arup's master plan with hundreds of pages covering the full content from the permissible range of heat transfer through condo walls to the surface area of ponds and canals.[50] Two months later, Arup standardized their work and issued sustainable design principles. The guidelines focused on building portfolios, technology and strategy explanation. It provided guidance on defining key design parameters and key performance indicators in the next phase of the project.[51]

During the first ten months of 2007, Arup was engaged in three work streams on the Dongtan project including: 1) defining key pieces of infrastructure in the context of China undergoing an evolution of its energy regulations; 2) proposing a phase plan for 80,000 residents; and 3) helping the client generate the following two-year plan and five-year plan especially for World EXPO 2010. The work covered the key technologies, elements and systems to be implemented and key economic constraints.[52] In November and December 2007, Arup codified the knowledge from this work and bundled it into a CD to make it reusable in workshops with SIIC or other clients.[53]

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49 Interview with Roger Wood.

50 Wired Magazine: Issue 15.05 Pop-Up Cities: *China Builds a Bright Green Metropolis.*

51 Interview with Braulio Eduardo Morera.

52 Interview with Braulio Eduardo Morera.

53 Interview with Braulio Eduardo Morera.

In the same year, Jonathan Maxwell launched a new spin-off firm SCDL (Sustainable Development Capital LLP) from HSBC. After one year's involvement in the Dongtan project, Jonathan Maxwell realised the financial and development thinking had to be integrated. The combination could neither be realised in engineering-based firms nor easily in banks. Jonathan Maxwell remarked that participation in the Dongtan project had shaped the character and organisational structure of his new firm;

> *"our role in this has been to design the commercial development financial component strategy, to think through the funding structure, to figure out how people would then fit into it…so fund really here has been tailored to…to try and use the Dongtan experience …it's almost all from our own experience from working on a project like this that we've built the firm".*

In 2008, Arup produced four volumes of basic guidelines based on their experience in the Dongtan project.[54] Braulio Morera tried to explain the differences between the control plan and design guidelines that Arup had delivered by that time. *"The difference between a control plan and design guideline is that in here you explain the technologies in design guideline. You explain the strategies in the control plan"* Braulio explained. *"Sustainable guideline, is basically the document that gives you the information about how to decide what are the key parameters you have to follow, the key performance indicators that your proposal has to achieve."*

Later in 2008, the Dongtan project stalled largely due to the political scandal of Shanghai mayor. In hindsight this event represented the end of an active role for Arup in delivering the Dongtan project. It did not mean that Arup suffered a significant setback in their eco-city business. Actually Arup had moved onto a couple of promising eco-city projects and constantly transferred the learning from the Dongtan project to their following projects in China and other regions.

Short Summary

The unprecedented design challenges as well as potential commercial risks of undertaking the Dongtan project had forced Arup to rethink their established organisational structure and practices. Arup responded by reconfiguring internal resources, assembling a new business unit, creating new digital tools and developing unconventional design methodologies. The valuable knowledge and novel experience gained from Dongtan equipped the company with great capacities to enter, grow and shape the nascent sustainable urban development market. (Table A.2).

54 Interview with Alejandro Gutierrez.

2008	
Jan	Dongtan: SIIC, Arup, HSBC, SDCL, Tongji University signed MOU (implementation) with Gordon Brown, Shanghai Mayor Han Zheng
2007	
Sep	Dongtan: Arup, HSBC presentation to PM Brown, China Task Force
Apr – Sep	Dongtan: China, UK universities formed educational partnerships
Apr	Wanzhuang SIIC Arup signed Main contract
Apr	Zhujiajiao: SIIC, Arup signed Agreement
Apr	Huzhou: SIIC, Arup signed First Agreement
Apr	Dongtan: Deputy PM John Prescott visited the Dongtan site
Jan	Dongtan: SIIC, HSBC signed MOU
2006	
Dec	Dongtan: Arup issued Sustainable Design Guidelines
Nov	Wanzhuang: SIIC, Arup signed Agreement for first phase
Sep	Dongtan: Arup issued Control Plan document for Start-up area
Mar	Tangye: SIIC, Arup signed Agreement
2005	
Dec	Dongtan: Arup issued First Design Report for Start-up area
Nov	Dongtan: SIIC, Arup signed MOU (planning) with President Hu & PM Blair
Aug	Dongtan: SIIC appointed Arup for Master plan of Start-up Area
Jan	Dongtan: SIIC appointed Arup for Dongtan Energy Centre concept
2004	
Aug	Dongtan: Arup issueed First Vision for development
Jun	Dongtan: SIIC appointed Arup for developing vision

Table A.2 Key Milestones of Arup's Eco-business During the Dongtan Project [55]

55 Arup report: SIIC & Arup Partnership – delivering a new paradigm of urban development.

Consequences – Arup's involvement at the post–Dongtan stage (2007 – 2010)

At the post-Dongtan stage, Arup was awarded several similar eco-city projects. The firm's capability to think and execute had largely evolved since the Dongtan plan was initially formulated. We found that both Arup's capability for managing the complex systematic design and the novel design methodology had been incorporated into the Northstowe project.[56] Many of the people who worked in the Dongtan project were also involved in the Northstowe project, the first time that the integrated design methods were tested since their creation. The testament was further carried out in another two Chinese master planning projects as well as the Jeddah central area development project.[57] While Arup realised the integrated design approach was novel and unique in the nascent field, they were also aware that the logic of the approach did not fit with the conventional practices of the traditional built environment. Moreover, Arup had realised other industrial competitors would have gained similar skills and resources were they to work on eco-city projects in the near future.

To capitalize on the first-mover advantage over others in the market, Arup devoted a great amount of effort to promoting their vision, method and capabilities in eco-city planning. They were actively involved in public media activities and worked on eco-city projects not only in China but all over the world. They leveraged their pioneering experience and skills by releasing the newly explored design principles into the market. They promoted and legitimized this new design method to demarcate their part in leading and shaping the nascent market for eco-city design (i.e. sustainable urban design solutions). Arup also branded the newly established design principles as their holistic consulting package and claimed that the methodology would be essential for any eco-city project. The legitimation of the 'negotiated urbanism' philosophy facilitated Arup's transformation from an engineering-based company to a global consultant. The organisation had gradually been recognized as a provider of unconventional, holistic and sustainable solutions in the built environment. According to our statistics, Arup's mainstream media coverage in the nascent eco-city market was more significant than any other competitor providing similar professional services. Unsurprisingly, Arup was consequently awarded a number of ecological urbanism projects not only in China but all over the world. The following section addresses Arup's involvement in other eco-city projects post-Dongtan.

Ebbsfleet Valley Master plan Project (2007)

56 Northstowe aims to build a new town on an airfield site with 10,000 dwellings and associated services and infrastructure. Arup compiled a report detailing environmental demands of a large mixed-use development proposal, detailing sustainable infrastructure options and models.

57 Interview with Malcolm Smith.

The Ebbsfleet Valley development (2007) was the largest regeneration project in Western Europe, three times the size of Hyde Park, sited in a vast quarry in North Kent. It consisted of nine new developments, 10,000 new homes, a new commercial centre, mainline connections to Paris and London from the Ebbsfleet International Railway Station and a 50-metre Ebbsfleet Landmark commission. The Ebbsfleet Valley development aimed to create a unique vision for future cities and setting a benchmark for urban development in the UK and Europe.[58]

In September 2007 Land Securities commissioned a 7.4-million square feet integrated master plan surrounding Ebbsfleet International Railway Station from Arup. The project team developed and worked to a set of project objectives embracing sustainability targets and the interests of surrounding communities. Ebbsfleet was the project where Arup first tested the parameters and design philosophy derived from Dongtan. The whole optimization process from digital modeling to cohering technical data streams was only repeated twice in the Ebbsfleet project, compared to three times for the Dongtan project. It was also the first time that Arup charged the client for the cost of using IRM. The total cost that Arup charged for using IRM was less than many accumulated pieces of costs demanded from other competitors. However, the project manager Malcolm Smith, a director of Arup Urban Design London, suggested the limitation of Arup's IRM approach.[59]

> *"You know, we used that on Northstowe, the new town north of Cambridge, which was the prototype eco-town. And did it work successfully? You know, off the record no, it didn't… (The reason could be) there (was) a lack of cultural resonance… I reckon we got, you know, 50% to 70% of the systems working, but we didn't get the kind of connections into the economics that we think we need to do. And we didn't get some of the other things working."*

Another unconventional part used in the Ebbsfleet project was Arup's cultural planning services. Land Securities were meant to establish a unique cultural identity for Ebbsfleet Valley and demanded a vision document from Arup. The cultural planning task involved substantial consultation with the boroughs of Gravesham and Dartford, Kent County Council , as well as arts and cultural organisations in Kent, the UK and abroad. Also, Arup worked closely with the client who had a strong opinion on how the site should be developed considering its historical background.[60]

The Ebbsfleet and Dongtan projects almost coincided. Slightly lagging behind Dongtan, Ebbsfleet became the first project to redeploy and testify Dongtan's novel sustainable design

58 http://www.futurecity.co.uk/projects/17

59 Interview with Malcolm Smith.

60 Interview with Jeffery Teerlink.

methodology. Although the project teams struggled to fully apply the methods to the Ebbsfleet development, they identified clear space for improvement in the IRM approach (i.e. the necessity of connecting economic analysis to the design model). Moreover, the dynamic exchange of knowledge and experience between the two projects were recognized and valued.[61]

Wanzhuang Eco-city project, Beijing, China (2007)

The Wanzhuang Eco-city project was a proposed development 40 km south east of Beijing. It was the client's (SIIC) intention to create a master plan, establish the infrastructure and sell the land at an increased value. SIIC also hoped to demonstrate how China's urban-rural gap should be solved with a view to achieve harmonious urbanization through the successful development of Wanzhuang.

In 2007, SIIC commissioned Arup to adopt a similar approach to the one used in the Dongtan project to prepare for detailed master plan and sustainability design guidelines. They assembled a multidisciplinary design team to prepare a structural, control and detailed plan plus sustainability design guidelines. As the Wanzhuang project started two years after Dongtan, many of the design team members had previously worked on Dongtan. Although the context of the two projects was quite different, the specialists involved were similar.[62]The multidisciplinary project team was commissioned to work on an integrated sustainable urban, transport, energy, water, IT, environmental, socio-economic, micro-climate, cultural, IRM, geotechnics, sustainability and risk management strategy and business case at all stages of the project.

In terms of the technical design aspects, the understanding of ecological urban planning had evolved since the Dongtan plan was formulated. As Peter Head said, Arup recognized that *'capturing and storing water in an urban development (in a climate where water is scarce) on the right scale could provide irrigation water for adjacent farmland. With nutrient recycling, a system like this could also lift the rural and urban economy*'.[63]

Jeffery Teerlink, a senior architect and team leader with experience of working on both Dongtan and Wanzhuang suggested the learning curve from Dongtan was so steep that he saw knowledge and experience being transferred and regenerated in the Wanzhuang project.

> *"I would say, from that exercise looking at who all got involved in those first years and a half of Dongtan, that almost became a template for what we could*

61 Interview with Volker Buscher.

62 Interview with Jeffery Teerlink.

63 Interview with Peter Head, http://www.sustainablecityblog.com/2010/01/dongtan-delayed-but-not-dead/

use in Wanzhuang. Although it was a very different context, physical context, the specialties involved were very similar."

Clinton Climate Initiative C40, Global (2009)

In June 2009, Arup signed a memorandum of understanding (MOU) with C40, a group of leaders of 40 of the world's largest cities, also called the Clinton Climate Initiative. Arup had agreed to help former US president Bill Clinton's charitable foundation advise major cities around the world on tackling global warming. Arup's expertise on sustainable integrated development were considered beneficial to the C40 cities in reducing greenhouse gas emissions, emphasised by David Miller, mayor of Toronto and chair of the C40. Arup promised to use their capability to address complex interdependent factors in the built environment to assist cities. Integrated solutions would be used to tackle the potentially harmful effects of climate change and maximize effectiveness. [64]

The main benefits for Arup was that they would be able to demonstrate the breadth of their business and position themselves along with consulting elites such as McKinsey and Price Waterhouse Coopers who have been heavily involved in helping cities to develop eco-initiatives. The involvement certainly provided Arup with some degree of legitimacy in the nascent market of eco-city development. Peter Head was appointed as the champion using the C40 relationship to communicate with other global parties on behalf of Arup. Instead of directly selling Arup's capable expertise, Peter influenced the wider macro-climate by creating a general vision of an emergent ecological age. Sally Quigg, Arup global marketing and communication group associate, commented that knowledge transfer from internal to external environments often took place in the form of workshops, project templates and key individual communication. She hailed Peter's personal impactful move for Arup,

"I think Peter's been very brave in taking something that's quite visionary, and, actually, took a long time to come to fruition."

Sally also identified the change of global attitude towards sustainability as a result of Arup's proactive participation for global eco initiative,

"I see the regional chairs from the Americas, and very senior people in East Asia and Australia really want to be involved in what Arup, in the cities initiative that we're starting up. It's an opportunity to share information, and best practice, and that's a huge step forward."

Peter Head himself called Arup's approach to the external environment as an 'explosive outreach from a single Dongtan point',

64 http://www.building.co.uk/story.asp?sectioncode=284&storycode=3141766&c=0

"LDA teams were thinking about London and they developed a London Climate Change Action Plan and lots of the thinking in it was actually really supported by what we did in Dongtan. So actually the London Climate Change Action Plan, which was eventually launched on 27th February last year and which has had a big impact on the Clinton initiative which is now running with 40 cities, was actually inspired by the Dongtan work … that sort of explosive outreach is really quite formidable actually."

Destiny Florida Eco-city from scratch, United States (2009)

Located in central Florida in the US, Destiny Florida was proposed by the property entrepreneur Anthony Pugliese as an eco-city development the size of Washington DC. Arup, having impressed Clinton and actively being involved in Clinton Climate Initiative, helped to draw up a master plan for the proposed eco-city from scratch.

The aim of Destiny was to position itself not just *"as the global model for sustainable building in the 21st century but also become the hub of green technology — like a [green] Silicon Valley for the United States, if not the world."* Destiny was also the largest of 16 sites chosen by Clinton alongside projects in London, Berlin, San Francisco and Warsaw. [65]

Knowledge fed into Dongtan project

It is worth mentioning was that the knowledge transfer was not a one-way process (from Dongtan to subsequent projects). This section illustrates a few examples of what Dongtan designers learned from past experience, transferring knowledge and experience from established projects to Dongtan.

1) from the Platja de Palma project to the Dongtan project

Platja de Palma is an urban beach near a residential area on the island of Mallorca, Spain. The transformation initiative, promoted by the Playa de Palma Consortium and the Spanish Central Government, aimed at a comprehensive revitalization (urban, environmental, social, and economical) of the area, with a sustainable approach.

Arup was responsible for the sustainability strategy for the project and specialists proposed ways to improve safety and environmental quality, generating a sustainable destination which would have minimal impact on the climate and adapt to climate change. Arup generated integral urban regeneration measures to implement their sustainability strategy.

Alex Mitchell, a senior environmental consultant in the Planning Plus group suggested that the Dongtan waste team applied part of the integrated system which managed the entire waste stream in Mallorca into the Dongtan project. He used the knowledge transfer from waste

65 http://www.timesonline.co.uk/tol/news/environment/article6493357.ece

management in Platja de Palma to the Dongtan project as an example of the many existing practices that the Dongtan project team had reviewed and adopted in their explorative design process.

> *"And is still being looked at, where we did go out there and have a visit, we haven't actually physically been there. So, I think there are…there are small things from all around the world that currently exist today. The key thing about Dongtan and any of the other work we're doing is putting it all in one place at one time and having it all function together."*

2) from the Dubai Waterfront and Doha regeneration to Dongtan

The Office for Metropolitan Architecture (OMA) designed the master plan for Waterfront City proposal for Dubai. Waterfront City would form a vibrant centre for the larger 140,000,000 m^2 Waterfront development. Waterfront is Dubai's largest development to date providing homes for a prospective 1.5 million new inhabitants, effectively doubling Dubai's population and creating one million jobs. [66]

Arup was involved in the Dubai Waterfront master plan review of a 120km^2 site in Dubai for Nakheel with a focus on sustainability performance. Alejandro Guiterrez was the design leader in this review project.

When working on the Dongtan project, Alex Mitchell communicated with Rainer Zimmen who worked on the Dubai Waterfront review project. Alex applied the knowledge developed from the Waterfront project to Dongtan. Jeremy Watson, Arup's global R&D director, stressed that not only did the Dongtan project offer information to other eco-cities, but that it was a dynamic mutual learning process.

> *"because he, kind of, explained very carefully to us how the Waterfront project in Dubai was now feeding a lot of information into the next phase of Dongtan. So, we kind of…everybody was having this idea about Dongtan is feeding information to other eco-cities, but it's not run one way, it's the dynamic thing, and I think that's very important for…for Arup to remember this, when they do the next big project, that…that they're running in both ways, especially because you have these phases"*

Arup's other related eco-city activities

In July 2007, the UK government was planning five eco-towns with zero or low carbon housing. Arup was employed by Gordon Brown, the then UK prime minister, to plan and design the first 10,000-home development.

66 http://www.dezeen.com/2008/03/12/waterfront-city-masterplan-by-oma/

In February 2009, Arup and the Administrative Committee of China's Wuhan Economic & Technology Development Zone (WEDZ) signed a Memorandum of Understanding for the master planning of a 'Demonstration Industrial Park for Energy Saving and Environmental Protection'. The proposed eco-industrial park was to be located within the WEDZ.

In May 2009, Singapore-Nanjing Eco High-Tech Island project was jointly undertaken by a Singapore consortium and Nanjing partners.

In June 2009, Arup and Davis Langdon completed a sustainability study report for the Property Council of Australia, adding weight to the push by the property industry for the federal government to do more to encourage refurbishment and retro-greening of existing buildings.

In June 2009, Arup was reported to serve as advisers on the Dallas Eco-city Project. The consulting members included Peter Head, recognised as a champion in ecological development.

In June 2009, Peter Head, Project Director for Arup, said: *"I am delighted that it has been possible to use Arup's methodology, developed in China, to help move London's first zero carbon project forward really quickly."*

Arup and an international firm, Tec Architecture, were appointed to design Hamburg-Harburg Harbour, Germany as a sustainable eco-city. Implemented from September 2009, the development of the eco-city aimed to combine industry, entertainment and pedestrian life into one super green package and achieve the highest level of environmental certification from all three major green building rating systems (LEED, BREEAM and DGNB). Working in close cooperation with all stakeholders, Arup and Tec Architecture adopted a synergistic approach to cover the immediate environmental context of the project. Tec Principle Sebastian Knorr suggested that the iconic eco-city project would become a model for sustainable urban development for the world.

In September 2009, IBM announced the launch of an eco-city research centre in China. China was looking to eco-city planning and management systems that could scale up to house 350-400 million more people by 2020.

In September 2009, Kampala, Uganda — the redeveloped Naguru and Nakawa housing estates announced that they would transform the current slums into two ultra-modern eco-conscious towns for 30,000 people.

In December 2009, Peter Head was involved in the Mayors Summit which brought at least 60 mayors from the world's largest cities together to claim that cities and regions would lead the low carbon revolution. [67]

Conclusion

This report studies the process of Arup's involvement in the eco-city business in the first decade of the 21st century. It identifies the key elements in Arup's approach in the process of designing and managing a breakthrough project, the Dongtan eco-city development. Having addressed the founding, history, values, and vision of Arup, the study emphasises Arup's activities at the antecedent, main involvement, and consequent stages of the Dongtan project. We discovered that even when confronted with fuzzy challenges and risks, Arup saw the long-term opportunities in the emerging eco-city market and strategically positioned the breakthrough project in-house. The organisation engaged in an exploratory and trial-and-error process of radical innovation which resulted in the development of a radically new multi-disciplinary approach known as the "integrated sustainable design" methodology, supported by a range of skills, a new matrix organisation and digital tools. For example, the "Integrated Resource Model" was developed as a software and conceptual tool for rapid testing and increased collaboration between different professions – engineers, architects, and social scientists – to identify systemic interaction across the multiple components of the design. It enabled Arup to better understand how changes in one component would impact on other components of the city.

Arup's success with the Dongtan design project was instrumental in winning subsequent eco-city projects in China and elsewhere in the world. We identified that Arup redeployed the novel knowledge, tools and technologies created in the Dongtan project into subsequent projects and public initiatives across China, the UK and elsewhere in the world. We also found the company purposefully getting involved in external activities through entrepreneurial actions to convey the vision of future cities and an incoming ecological age for the general public. For example, several managers were prominent in setting the political agenda and promoting Arup's concept of integrated urbanism. They were closely engaging in public forums and media (e.g. Times Magazine and Wired), policy discussions (e.g. the UN and the Clinton C40 initiative), international conferences and collaboration with leading universities. By doing so, the company entered, grew, and shaped the notions of the emerging market in eco-city design. They also successfully promoted and reinforced their innovative design philosophy, methodology and tools to build legitimacy in the nascent field.

67 http://www.ubmvirtualevents.com/wp-content/uploads/2010/01/Copenhagen_and_Construction.pdf

Sub-Study 1 – Beddington Zero Energy District (BedZED), London, UK

The Beddington Zero(fossil) Energy District (BedZED) is a mixed-use district located on a former industrial site in the London borough of Sutton on the southern edge of the city. Prior to development, the City of London owned the post-industrial site on which BedZED would be constructed. The city held an auction for the land and solicited bids from developers. Peabody Trust of London submitted the winning bid. In 1999, Peabody Trust, the primary financial coordinators and backers, officially appointed Arup as part of the design team for the project.

Work investigating the design ideas actually began five years before the start of BedZED. Bill Dunster Architects had previously built their own house to test some of their ideas through close collaboration with the Arup team. They worked together to develop and verify the ideas which were about seeking the balance of social and financial issues alongside ecological impact and resource consumption.

BedZED began construction in 2000 and was completed by 2002. By October of 2002 all the housing units, office and work space had been occupied. Total development cost was slightly over $15 million, not including land acquisition. The project went over budget by approximately 30%, due to complications but did not fall behind schedule.[68] Arup was deeply involved in working with Peabody on the development of factory prefabrication, volumetric housing, and the manufacture of completed building sections ready for simple finally assembly on site.

Generally speaking, BedZED did not require public leadership or support to be built. While it was a large project, it was not so large that it could not be privately financed and developed. BedZED did, however, benefit from one particular public policy that allowed developers to exceed density maximums if they agreed to meet specific environmental performance measures. In this way, the city did not lose any money in the bids it received and BedZED was able to compete with higher-return developers. Aside from this policy that benefitted BedZED, the project had to go through the usual planning approval processes. BedZED also benefitted from an exceptional degree of institutional leadership and agreement. The major stakeholders in the project—Bill Dunstler Architects, BioRegional, Peabody Trust and Arup — shared a common vision and were able to execute the project quickly and efficiently.

Arup demonstrated their knowledge and experience of generating a sustainable model for living and development through the entire project life cycle: from construction through occupation and use. Compared to the Dongtan project, BedZED created fewer challenges due to its much smaller scale and scope. Moreover, the Dongtan project forced Arup to work

68http://assets.ecorussia.info/assets/paragraph_attaches/5757/paragraph_media_5757_original.pdf?1269787955

within an unfamiliar governmental framework associated with ambiguities in the understanding of local culture and needs. Having addressed that, Arup still considered their experience of working on the BedZED project as the pre-practice for taking over the unprecedented Dongtan project in 2005. [69]

Chris Twinn, Director of the Arup Building Engineering Sustainability Group, was the leading engineer involved in BedZED. He suggested Arup had already mastered a lot of elements/knowledge in sustainable building design but never integrated them on a large scale. Arup was the design engineer in the BedZED project but not the system integrator who would strategically oversee the whole project. Compared to BedZED, the Dongtan project provided an excellent opportunity for Arup to foster the total integration exercise which they seldom used before.

Client: Peabody Trust
Architect: Bill Dunster Architects
Engineer: building physics, energy, M&E systems: Arup (Chris Twinn etc.)
Environmental consultant: BioRegional Developments
Structural & civil engineer: Ellis & Moore
Cost/site management: Gardiner & Theobald
CHP supplier: B9 Energy Biomass
PV supplier: BP Solar
Wind cowl supplier: Vision
Specialist water utility: Albion Water

69 Interview with Chris Twinn

Sub-Study 2 – Two Parallel Eco Projects in China

Huangbaiyu eco-village (400 houses built)

William McDonough + Partners designed an eco-village of 400 houses in Huangbaiyu in northeast China[42]. The houses were built in the village and the project overall was on a more modest scale than Dongtan. The plan called for affordable solar-powered bungalows using local materials in a bid to free more land for farming. Instead, the developer built suburban-style tract homes that most local families have shunned, according to a PBS documentary earlier this year.

Huangbaiyu gained a public high profile in its affordable houses as well as its design model of Sustainable Home. Nevertheless things didn't work out as planned. The first 42 houses were completed in late 2006, only three used the eco-friendly bricks. Among them, only one house had solar panels and none faced south.

There were even more complaints that the village didn't create enough jobs. Villagers complained that they did not wish to move to the village centre and that they had never been consulted in the planning. As a traditional architectural firm, McDonough struggled to realise the economic viability of the village, which typically is the foundation of sustainable development of any place. They admitted their design lacked consideration for the population that it was supposed to be serving.[70] This failure also highlighted that it is unwise to employ an architect to be fully responsible for planning a town, a city or a community. The lessons learnt from this project strengthened the philosophy of the integrated design approach that Arup promoted and adopted.

Rizhao (a smaller scale with a more effective outcome)

Rizhao is an ordinary city with a population of three million people located at the Shandong coast. The local government chose to convert as much as possible of the city's energy consumption to solar power rather than develop it into a high standard eco-town. The outcome of the project was that an impressive 99% of households in the city centre and 30% in the suburbs used solar panels to power lights and 6,000 households powered cooking. Traffic signals, streetlights and most of the lighting in city schools relied on solar energy.

Instead of develop a new city from scratch, the municipal government encouraged households to use solar panels. The government heavily subsidized solar powered equipment

70 http://features.csmonitor.com/environment/2008/12/23/in-china-overambition-reins-in-eco-city-plans/

and each household saved hundreds of dollars every year. The result was a significant reduction in electricity and coal use: Rizhao has frequently been on the top ten list for good air quality assessed by State Environmental Protection Agency's in China.[71]

Many other towns like Rizhao, attempting smaller scale development that Dongtan-style 'grand projects', have made a difference and seemingly have found a successful path to long-term sustainable urban development. They do not involve international collaboration and typically get little or no publicity, but focus on improving places where people already live. The Rizhao project offered a great example of collaboration among local officials, government, communities and entrepreneurs.

71 http://www.ethicalcorp.com/content.asp?ContentID=6314

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