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A CONFIGURATION FRAMEWORK OF MANUFACTURING STRATEGY PARADIGM IN STATE OWNED ENTERPRISES WITHIN CHINA'S PETROCHEMICAL INDUSTRY

- Building Context-embedded Configurations for the Paradigm of Strategic Manufacturing Management from Exploratory Case Studies

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THESIS SUMMARY

The role of the production system as a key determinant of competitive performance of business operations has long been the subject of industrial organization research, even predating the explicit conceptualisation of manufacturing strategy in the literature. Particular emergent production issues such as the globalisation of production, global supply chain management, management of integrated manufacturing and a growing e-business environment are expected to critically influence the overall competitive performance and therefore the strategic success of the organization. More than ever, there is a critical need to configure and improve production system and operations competence in a strategic way so as to contribute to the long-term competitiveness of the organization. In order to operate competitively and profitably, manufacturing companies, no matter how well managed, all need a long-term 'strategic direction' for the development of operations competence in order to consistently produce more market value with less cost towards a leadership position. As to the long-term competitiveness, it is more important to establish a dynamic 'strategic perspective' for continuous operational improvements in pursuit of this direction, as well as ongoing reviews of the direction in relation to the overall operating context. However, it also clear that the 'existing paradigm of manufacturing strategy development' is incapable of adequately responding to the increasing complexities and variations of contemporary business operations. This has been factually reflected as many manufacturing companies are finding that methodologies advocated in the existing paradigm for developing manufacturing strategy have very limited scale and scope for contextual contingency in empirical application. More importantly, there has also emerged a deficiency in the multidimensional and integrative profile from a theoretical perspective when operationalising the underlying concept of strategic manufacturing management established in the literature.

The point of departure for this study was a recognition of such contextual and unitary limitations in the existing paradigm of manufacturing strategy development when applied to contemporary industrial organizations in general, and Chinese State Owned Enterprises (SOEs) in particular. As China gradually becomes integrated into the world economy, the relevance of Western management theory and its paradigm becomes a practical matter as much as a theoretical issue. Since China markedly differs from Western countries in terms of culture, society, and political and economic systems, it presents promising grounds to test and refine existing management theories and paradigms with greater contextual contingency and wider theoretical perspective. Under China's ongoing programmes of SOE reform, there has been an increased recognition that strategy development is the very essence of the management task for managers of manufacturing companies in the same way as it is for their counterparts in Western economies. However, the Western paradigm often displays a rather naive and unitary perspective of the nature of strategic management decision-making, one which largely overlooks context-embedded factors and social/political influences on the development of manufacturing strategy.

This thesis studies the successful experiences of developing manufacturing strategy from five high-performing large-scale SOEs within China's petrochemical industry. China's petrochemical industry constitutes a basic heavy industrial sector, which has always been a strategic focus for reform and development by the Chinese government. Using a configuration approach, the study has focused on exploring and conceptualising the empirical paradigm of manufacturing strategy development practiced by management. That is examining the 'empirical specifics' and surfacing the 'managerial perceptions' of content configuration, context of consideration, and process organization for developing a manufacturing strategy during the practice. The research investigation adopts a qualitative exploratory case study methodology with a semi-structured front-end research design. Data collection follows a longitudinal and multiple-case design and triangulates case evidence from sources including qualitative interviews, direct observations, and a search of documentations and archival records. Data analysis follows an investigative progression from a within-case preliminary interpretation of facts to a cross-case search for patterns through theoretical comparison and analytical generalization. The underlying conceptions in both the literature of manufacturing strategy and related studies in business strategy were used to develop theoretical framework and analytical templates applied during data collection and analysis.

The thesis makes both empirical and theoretical contributions to our understanding of 'contemporary management paradigm of manufacturing strategy development'. First, it provides a valuable contextual contingency of the 'subject' using the business setting of China's SOEs in petrochemical industry. This has been unpacked into empirical configurations developed for its context of consideration, its content and process respectively. Of special note, a lean paradigm of business operations and production management discovered at case companies has significant implications as an emerging alternative for high-volume capital intensive state manufacturing in China. Second, it provides a multidimensional and integrative theoretical profile of the 'subject' based upon managerial perspectives conceptualised at case companies when operationalising manufacturing strategy. This has been unpacked into conceptual frameworks developed for its context of consideration, its content constructs, and its process patterns respectively. Notably, a synergies perspective towards the operating context, competitive priorities and competence development of business operations and production management has significant implications for implementing a lean manufacturing paradigm. As a whole, in so doing, the thesis established a theoretical platform for future refinement and development of context-specific methodologies for developing manufacturing strategy.

Key words or phrases:

Strategic Management of Business Operations, Manufacturing Strategy, Management Paradigm, Contingency Theory, Configuration Models, Exploratory Case Study, SOE Reform, Corporate Management in China

Dedication

To my dear dad and mom, without whose enduring support, encouragement, love and sacrifice this work would not have been possible.

To dear Dr. Nelson K H Tang for his always generous care, guide, effort and time of which he left too little to look after himself. In heaven may he be pleased to see the final completion of this thesis as I promised him on the last day of his life.

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“The smile on the face that reveals true joy always comes from deep within; it springs from a heart that is full of thanks that's where our joy must begin.”

- Fitzhugh

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1. Overview of the Research Project

1. 1. Introduction

This chapter provides an overview for the research project. The chapter is structured along the six essential constructs of the thesis.

The first construct is the 'theoretical foundation of the research'. In this section, the underlying concepts of strategic management of business operations are first summarized (see Chapter 4, section 4.2 for details). Then, the inseparable relationship between 'strategy development' and its embedded 'context' is emphasised by considering the essential features of strategy development practice as discussed in the literature (see Chapter 4, section 4.3 for details). From the above, the contingency thesis of the research is defined and further reflected from a manufacturing strategy perspective (see Chapter 3, section 3.6.1 for details). Following this overall theoretical thesis, the central phenomenon under investigation is defined as the 'management paradigm of strategy development'. Here the focus is on examining the decision-making practices so as to surface the managerial interpretations and perspectives when operationalising the concepts of strategic management through developing a strategy (see Chapter 2, section 2.1 for details).

The second construct of the thesis is a 'critique of limitations in the existing paradigm of manufacturing strategy development' and how these are reflected through theoretical and empirical issues raised by contemporary research and industrial practices, particularly in the context of China. A configuration model has been selected as the theoretical approach of the research (see Chapter 3, section 3.6 and 3.7 for details).

The third construct of the thesis is the 'scope of the research'. Given the limitations identified above, the goal of the research is, then, defined and confined. The aim of the research specified the main study subjects and further translated them into key research questions that needed to be answered. In this study the aim of the research is unpackaged into three research objectives (see Chapter 5, section 5.2 for details).

The fourth construct of the thesis is the 'overall research design and framework of analysis'. This explains 'how' the researcher has approached the subjects of study and 'what' the researcher has studied so as to answer the research questions (see chapter 4 for details).

The fifth construct of the thesis is the 'design and methodology of empirical investigations'. This indicates 'how' empirical investigation in the field was carried out and 'what' method was used to collect, analyse and interpret the data (see Chapter 5 for details).

The final construct of the thesis presents a summary of 'conclusions and implications of the research findings' (see Chapter 8 for details).

1. 2. Theoretical foundations for the research

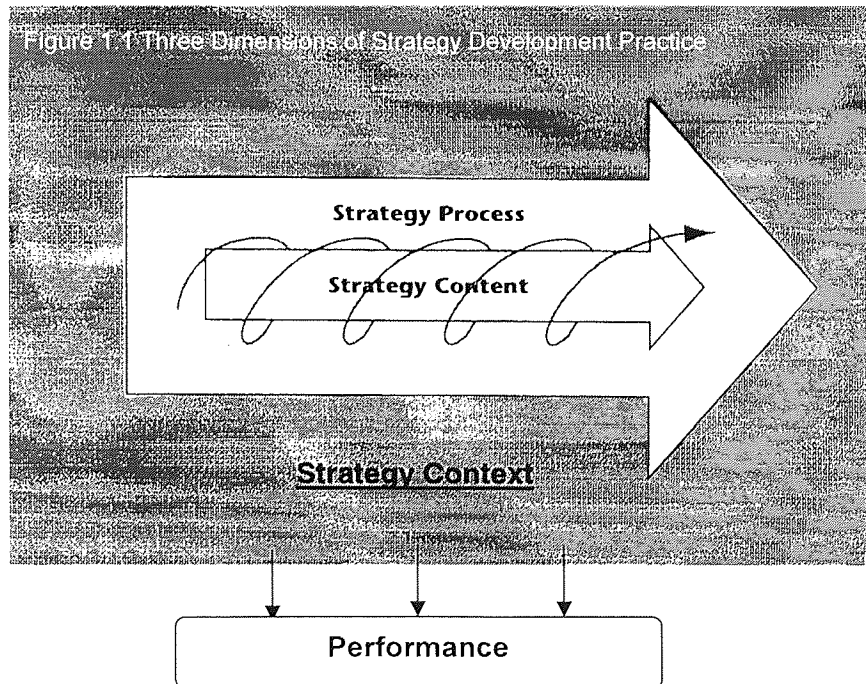
The role of the production system as a determinant of competitive performance of business operations has long been the subject of industrial organization research, even predating the explicit conceptualisation of manufacturing strategy in the literature. In the late 1960s, Skinner's (1969) seminal work made persuasive arguments that the design and operation of production system should be aligned with the overall operating context and reflect the competitive priorities of the business, rather than always simply seeking internal consistency and operational efficiencies.

- Theoretical Thesis

It has long been widely recognized in the literature that strategic management is the essential mediating force between the firm's operations and its embedded context both internal and external (Mintzberg, 1987b, p.21). The essence of strategic management, as Mintzberg (1990) and Eisenhardt and Zbaracki (1992) suggest, therefore, is to reconcile the capabilities of operations resources with the market requirements so as to adequately reflect and fully exploit particular environmental forces and organizational conditions with which the firm is engaged. The ultimate goal of strategic management, as Mintzberg (1987a) suggested, is to consistently improve operations competence and performance in relation to the overall operating context for contributing, sustaining, and further strengthening the long-term competitiveness of the firm as a whole. To achieve this, as Mintzberg (1987b) suggested, objectives of strategic management are setting direction for the development of competencies in relation to the operating context, maintaining consistent concentration on pursuit of that direction, and retaining flexibility to change should the direction become inappropriate for the long-term competitiveness. In short, its major outcome is to set a 'strategic direction' for business operations and, arguably more importantly, to establish a dynamic 'strategic perspective' for continuous operational improvements on pursuit of this direction, as well as ongoing reviews of the direction in relation to the overall operating context of the organization.

The above underlying concepts of strategic management established in the literature are made operational via management practices of 'strategy development' for business operations at various levels of the organization, what we can define as the corporate, SBU, and functional levels. It has been widely recognised that each strategy development phenomena is, by its nature, three-dimensional in nature. The three dimensions of 'strategy development' are its content, its process, and its embedded context (Mintzberg 1990 and 1997). Only by understanding all three dimensions will the researcher gain any real depth of comprehension of the strategist's perspective in operationalising the underlying concepts of strategic management during practice (Pettigrew and Whipp, 1989; Mintzberg, 1999; de Wit and Meyer, 1998).

Virtually all writers on strategic management agree that there is no "one best way" of strategy development, neither in its content nor in its process. The effective management of strategy development practice, both its 'content' and its 'process', is as Mintzberg (1990) suggested contingent upon the specific 'context' in which it occurs (both organizational and environmental context). That is, we understand 'what' is going on, 'how' and 'why', by appreciating 'where' and 'when' it is happening. Contingency theory simply holds that observations are embedded and must be understood within a context, and that the "best way" depends on the particular situation and circumstances. Contingency theory is especially pertinent to management and, in particular, strategic management. Relating the details of strategy development practice (its content and its process) to the details of its embedded context has long been the 'major thesis' of empirical studies in the business strategy literature and associations between the two have long been suggested by empirical evidence to have a profound impact on firm's long-term competitiveness (Miller and Friesen, 1978 and 1983; Hambrick, 1983; Porter, 1980; Mintzberg, 1973). In accordance with these views, it must be emphasized that effective use and refinement of a strategy development framework, either to its content or to its process, has to be conducted with substantive understating of the embedded 'context' and with an intimate tie to long-term performance.



The goal of strategic manufacturing management is the effective use and development of production system as a competitive weapon to contribute to the long-term market competitiveness of business operations (Skinner, 1969 and 1978). It has long been widely recognized in the literature that effective positioning of a production system within the overall operating context of business can be achieved through the development of a manufacturing strategy (Hayes and Wheelwright, 1984 and 1985).

The 'content' of manufacturing strategy refers to the specifics of "what" is decided - a series of decisions made that, over time, enables the firm to build appropriate manufacturing processes, infrastructure, and set of specific manufacturing capabilities (Hayes and Wheelwright, 1984). Manufacturing strategy content embodies both the choice of the most beneficial set of 'competitive priorities' in manufacturing for a business unit and the 'strategic decisions' pertaining to investments and action-programmes to build that set of capabilities prioritised (Ward et al., 1996). The 'process' of manufacturing strategy refers to "how" such choice is reached - the way by which the competitive priorities of manufacturing are determined and strategic manufacturing decisions come about over time (Skinner, 1978; Hayes and Wheelwright 1984; Adam and Swamidass, 1989). The embedded 'context' of manufacturing strategy development is best defined in the literature by Ward et al., (1996) and Hill (1994). Environment, organization structure and control system, as well as the competitive strategy of business operations, they suggest, are held to be the most critical contextual aspects of consideration with respect to manufacturing strategy development. Many other researchers have also offered conceptual models that consider the linkages between manufacturing strategy development and competitive strategy, environment, structure and power systems (Miller and Mintzberg, 1983; Kotha and Orne, 1989; Leong et al, 1990; Parthasarthy and Seti, 1992).

The above underlying conceptions of business and manufacturing strategy were used to develop theoretical framework for organizing empirical investigations into each of the three dimensions of manufacturing strategy development. This is presented in Chapter 4. To recap, the overall theoretical thesis of this study is 'contingency theory' namely to investigate manufacturing strategy development practice (its content and its process) in relation to its embedded context, and to analyse the performance implications of the associations between the two.

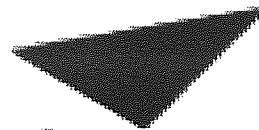
- Central Phenomenon under Investigation

Following the contingency thesis, the central phenomenon under investigation is defined as the 'management paradigm of strategy development'. The paradigm, variously called ideational culture, cognitive mind-set, and the interpretative scheme, is the deeper level of basic perspectives and beliefs shared by members of an organization that operate unconsciously and define in a basic "taken for granted" fashion an organization's view of itself and its environment (Johnson, 1988). The study of paradigm has long been regarded a major theme in social and organizational research to understand the internal logic of actors' interpretations on meanings of the phenomenon in a given context. As Laing (1967, p.53-64) and Burrell and Morgan (1979, p.5-6) suggest, it is the essential thesis of social and organizational science for conceiving human action as arising out of actors' subjectivities and is based on actors' perspectives and interpretations of reality. Human action is seen as purposive and becomes intelligible only when researchers gain access to that subjectivity. The social world, therefore, cannot be simply

understood in terms of causal relationships that do not take account that human actions are based upon the actor's perception and interpretation of events (see Chapter 2, section 2.4).

Environmental forces and organizational conditions undoubtedly affect the firm's performance, but do not in themselves manage the business operations and create strategy. It is people that manage, not "forces" or "facts" (Drucker, 1974); and it is perceptions and interpretations of the 'fact' that management and decision-making act on (Bourgeois, 1980; Miller and Friesen, 1984). As Johnson (1988), Mintzberg (1990), Eisenhardt and Zbaracki (1992) and Bailey and Johnson (1993) suggest, it is the core set of beliefs and perspectives that managers commonly hold that interprets the changes in organizational conditions and environmental forces. The core set of beliefs provides appropriate responses to align them in a holistic way through the strategic management of business operations. The "organizational action and processes" that give rise to strategy are, then, most likely to be shaped and related to the 'taken for granted' beliefs that are encapsulated in the perspectives of managerial experience and organizational culture evolved over time. Empirical evidence from the existing studies in the business strategy literature shows that the likelihood of a management paradigm dominating the development of strategy and giving rise to the multifaceted and situational nature of the strategy process becomes clearer when the wider social, cultural and political context in which it is embedded is considered.

2.3. Forming the Process in Integrative perspective



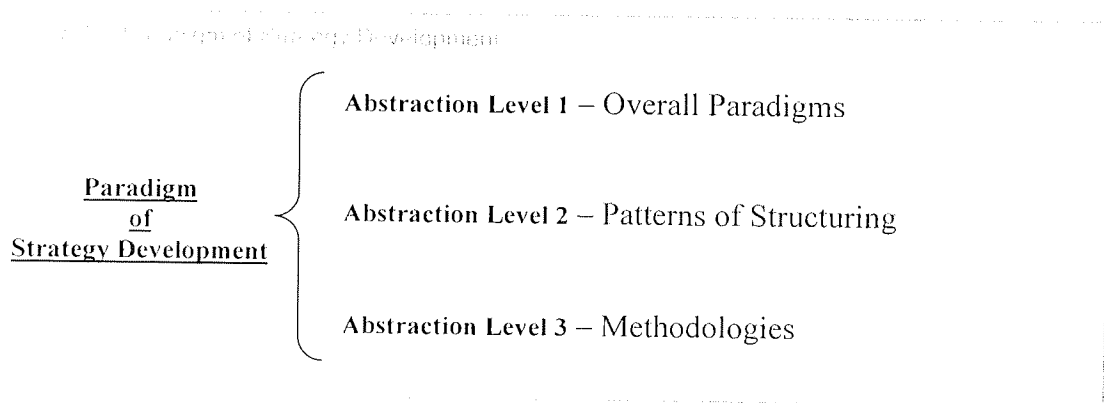
Aston University

Illustration removed for copyright restrictions

Adopted from Johnson (1985)

Given the above, the subject of "management paradigm" has been long been regarded as the key theme of research in the business strategy literature when investigating and understanding the effective management of strategy development practice, both its content and its process, in relation to the embedded context of business operations (Huff and Reger, 1987).

The paradigm of strategy development has been studied at three levels of abstraction in the business strategy literature (de Wit and Meyer, 1994 and 1998; Bailey and Johnson, 1993). At the highest level of abstraction, fundamentally different ways of conceiving strategy development can be recognized, which are referred to as the overall paradigms of strategy development. As noted by Huff and Reger (1987) in their review of the business strategy research, among the tensions are three essential sets of paradoxes regarding the overall paradigm of strategy development practices in the actual context of organization - Outside-in versus Inside-out, Top-down versus Bottom-up, Centralisation versus Decentralisation. At a lower level of abstraction, differing paradigms translate into differing patterns of structuring strategy development practices within the organization. This level of abstraction is referred to as patterns of strategy development. As noted by Mintzberg (1990), the pattern of strategy development comprises a multidimensional profile of conceptual designing or rational planning, systematic analysing or leadership envisioning; cooperative learning or competitive politicking; focus on individual cognition or collective socialization; or a simple response to the force of the environment. Finally, different patterns will give rise to different types of analytical methods and decision aids for strategy development. This level of abstraction is referred to as the methodology of strategy development. Anderson et al. (1991, p. 89) and de Wit and Meyer (1994, p.35) suggest that the overall paradigm and patterns of structuring strategy development define the "context" for applying and developing the methodology (analytic methods and decision aids).



Arguably the various frameworks developed in the business strategy literature more generally embrace two broad thrusts of management paradigm for strategy development when operationalising the underlying concept of strategic management during practice. One is that strategy development can be accounted by logical, rational processes either through the planning or the adaptive incremental change. Mintzberg and Waters (1985) argue that the "logical and rational" view focuses on 'deliberate' strategies, in which the manager is a proactive strategy formulator consciously seeking to understand a complex environment. In so doing, the manager establishes causal patterns and formulates strategy by configuring organizational resources to meet environmental needs. The other is an "organizational action" view of strategy development where the strategy is seen as the emergent product of the political, programmatic, cognitive, or symbolic aspects of management embedded in the prevailing context. Organizational action view

focuses on 'emergent' strategies. Mintzberg and Waters (1985) suggest that the distinction between deliberate and emergent strategy goes to the very heart of debates on the management paradigm of strategy development. In fact, the concepts of deliberate and emergent strategy, especially in their interplay, form the basis for an analytic typology to interpret, structure and synthesize various descriptions and explanations (Hax and Majluf, 1988, p.107). However, after Mintzberg (1990), the effective management of strategy development practice involves not only the deliberate or emergent process operating in isolation of one another, but the interplay between the deliberate and emergent processes which act together to realize a successful strategy. Following such integrative perspective, researchers in the business strategy studies have established a multidimensional profile that encompasses a broad and diverse range of views on the paradigm of strategy development as discussed earlier. In comparison, the exiting paradigm dominated the manufacturing strategy literature is very narrow and unitary indeed.

1. 3. Limitations in the Existing Paradigm of Manufacturing Strategy Development

From the existing paradigm of manufacturing strategy development, there has emerged a deficiency of the multidimensional and integrative profile from a theoretical perspective when operationalising the underlying concept of strategic manufacturing management. This deficiency is reflected through its advocated conceptual models of the 'content configuration', the 'context of consideration', and particularly the 'process organization' for developing manufacturing strategy (see Chapter 3, section 3.6 and Chapter 4, section 4.3.2). There has also emerged a very limited scale and scope of empirically developed and tested contextual contingency for its application within the contemporary industrial organizations particularly regarding its methodologies for developing a manufacturing strategy. This limitation has been reflected as many manufacturing companies are finding that methodologies advocated in the existing paradigm are unable to effectively operationalise the concept of strategic manufacturing management in the contemporary context of business operations (see Chapter 3, section 3.3.1).

Several authors have identified the critical need to overcome such emergent 'theoretical' and 'empirical' limitations in the existing paradigm by studying successful experiences of manufacturing strategy development and exploring the empirical management paradigm in a wider social, cultural, and political business setting (Adam and Swamidass, 1989; Anderson et al., 1989 and 1991; Leong et al., 1990; Swink and Way, 1995).

From the existing paradigm, the concept of strategic manufacturing management has essentially been operationalised via a linear market-deterministic approach. The most prominent contribution is the work of Skinner (1969), who laid the conceptual foundation for a "top-down, outside-in" paradigm and provided a "rational planning view" demonstrating a pattern of manufacturing strategy development. His "Fifteen Step" model provided the first flow diagram of manufacturing strategy development (Skinner, 1969; 1978; 1985). Following this top-down rational planning paradigm, Platts and Gregory (DTI, 1988) take the 'manufacturing audit' approach and suggest a step-by-step, worksheet-driven methodology to strategy development. Hill (1989 and 1994) provides one of the most influential and complete contributions of methodology following Skinner's paradigm, presenting a five-step method for developing a manufacturing strategy. Others have provided analytical frameworks that act as decision aids in the manufacturing strategy development; for example, Skinner's (1974) dimensions of focus; Hayes and Wheelwright' (1979) product-process matrix; Marshall and Abernathy's (1975) trade-off analysis; Cleveland et al.'s (1989) production competence analysis; Slack's (1994) importance-performance matrix; Schroeder et al.'s (1986) MOPD (Mission, Objectives, Policy and Distinctive competence); and Abernathy's (1974) learning curve analysis; to name just a few.

The Skinnerian paradigm is prescriptive in nature, which sees the development of manufacturing strategy as a 'deliberate' and 'sequential' process in that its major concern is essentially on what managers should do rather than what does happen in developing a manufacturing strategy.

However, the popularity of the Skinnerian paradigm in the literature does not in itself prove that it is the universal "best way" - or even a sufficient way - to operationalise the concept of strategic manufacturing management in contemporary industrial organizations.

There has been another body of research in the literature that see the need for a "bottom-up inside-out" paradigm and "an organizational action view" to manufacturing strategy development (Hayes and Wheelwright, 1984; Hayes, 1985; Hayes and Clark, 1985; Wheelwright and Hayes, 1985; Hayes and Pisano, 1994). The first acknowledgement that manufacturing strategy should similarly go beyond a unitary consideration of deliberate rational planning came when Hays and Wheelwright (1984, p.30) cautioned that 'it is the pattern of decisions actually made that constituted a function's strategy, not what is said or written in planning documents'. Thus they advocate the possibility that paradigm of manufacturing strategy development might have 'emergent' as well as 'deliberate' features. Although this school of thought has not yet provided a formal methodology, Hayes and his colleagues did open up the debate on the unitary bias in the existing paradigm and initiated the development for a multidimensional and integrative profile for the paradigm of manufacturing strategy development.

From the critical literature review conducted by the author (See chapter 3 for details), serious critiques have emerged to challenge the unitary 'theoretical perspective' in the existing paradigm of manufacturing strategy development:

1. **The dichotomy of formulation-implementation is an unwarranted simplification to conceptualise the strategy development practice in the business reality of contemporary industrial organizations.**

From the Skinnerian paradigm the constructs of strategy development are usually formed in the strategy formulation stage and the strategy implementation stage. It is commonly presumed that this process is not only linear, but also largely rational – management identifies, determines, evaluates, chooses, translates and carries out, based on rigorous logic and extensive knowledge of 'all-important' factors. However, according to Quinn (1980), writers who exalt the virtues of the rational planning perspective make unsafe assumptions about the "knowability" of the environment and the rationality and controllability of organizations. The division of the strategy development practice into a number of sequential phases has also drawn heavy criticism from authors who believe that, in reality, no such identifiable stages exist. They dismiss the linear distinction of formulation–implementation and argue that the strategy development practice is more messy, with analysis, formulation and implementation activities going on all the time, thoroughly intertwined with one another. Mintzberg and Waters (1985) coined the phrase "strategy formation" as opposed to formulation-implementation to describe the intertwined and interactive practice of strategy development. They regard strategic thinking processes, strategic decision-making processes, and strategic change processes as the major constructs of study (see Chapter4, section 4.3.4).

2. Top-down hierarchical neatness has not been demonstrated by empirical research.

It has frequently been suggested that sustainable competitive advantage for a business unit results from building core capabilities or distinctive competencies and therefore functional capabilities may determine strategy (e.g., Hayes, 1985; Prahalad and Hamel, 1990; Stalk, Evans and Shulman, 1992). This suggests a bottom-up or 'middle-up and down' paradigm to manufacturing strategy development that has not been adequately considered in the literature.

3. Strategic planning is a necessary but not wholly sufficient, building block of strategy development practice.

The adequacy of deliberate planning as the patterning of manufacturing strategy development has also been questioned. Miller and Hayslip (1989) argue that strategy development should balance the use of both rational planning and incremental capability building. The implication of their argument is that the Skinnerian paradigm of manufacturing strategy development should be revised given the parallel and interactive nature of planning and competence building activities.

Adam and Swamidass (1989) and Minor et al (1994) pointed out that the theoretical development of manufacturing strategy seems to be endlessly stalled for want of high quality empirical research. They regarded this as the main reason for the limitations of the theoretical perspective from the existing paradigm. From the analysis of the literature (see Chapter 3 section 3.7 for details), the following weaknesses in the research method and focus of published studies have been revealed:

- **Cross sectional bias**

The majority of empirical studies are cross-sectional surveys. They tend to focus unduly on measurable quantitative factors using highly structured instruments or close-ended devices. Snap-shot research and close-ended instrumentation are, as Miles and Huberman (1984) noted, usually "context-stripped". Ward (1990) argues research on manufacturing strategy development requires examination of longitudinal data. There is a critical need for more longitudinal studies in order to examine how manufacturing strategy is developed, adopted, and modified over time in relation to the embedded context of business operations.

- **Lack of cross-functional integration**

Among the empirical studies reviewed, it is noted that researchers have detected a paradigm shift in organizations to what may be termed integrated manufacturing. Integrated Manufacturing (IM) is driven by the widespread adoption of Advanced Manufacturing Technology (AMT), Total Quality Management (TQM), and Just-In-Time management (JIT). With the increasing importance of IM, manufacturing organizations raise some basic questions as to the strategic implications

and use of IM. Minor et al. (1994) identified that cross-functional relationships, especially information exchange within the strategy process, have significant implications for the development of an effective manufacturing strategy paradigm. However, they have not been adequately studied by empirical research to date.

- **Lack of integration with the business strategy literature**

Surprisingly, research and theory in strategic manufacturing management has been largely developed independently from related streams in business strategy. Key concepts and major constructs have been well developed in the business strategy literature, especially regarding the managerial paradigm of strategy development. Amundson (1998) has argued that, by learning from related disciplines, researchers can exercise prudence without painfully 'reinventing the wheel'. Adam and Swamidass (1989) argued that manufacturing strategy researchers should build upon concepts and themes developed in the business strategy area. Integration of concepts, constructs, and methods developed in business strategy could yield immediate results in defining process constructs, which are presently lacking from the body of manufacturing strategy research (Ward et al., 1990, p. 196).

- **Contextual bias**

It is contended here that there has been only a very limited contextual variation in the empirical studies reported in the literature. Empirical studies of manufacturing strategy development are highly concentrated on developing process methodologies and analytical tools following the Skinnerian paradigm in traditional Westernised industrial settings, with little scope or explanation of the social, political and cultural context of the research. This emerging concern has been confirmed by Swink and Way's (1995) review of the literature. Swink and Way advocated that future empirical studies should devote more emphasis to investigating the 'context-embedded' management paradigm of manufacturing strategy development in the wider social, cultural, and political setting of contemporary business operations.

- **Lack of common terminology**

Anderson et al. (1989) and Ward et al. (1996) pointed out that, in order to advance the field, manufacturing strategy researchers must coalesce the various definitional concepts into emergent theoretical themes, especially when defining the process of manufacturing strategy development. They argue that the practical applicability of manufacturing strategy research will be greatly increased if a common language is developed between organizational and manufacturing strategy researchers, such as on the theme of "paradigm" advocated by the author here in this thesis.

Summarised thus far, while the Skinnerian paradigm of manufacturing strategy development is excellent for prescriptions on how management should manage a 'deliberate process' in the strategic management of production, it tends to focus unduly on measurable quantitative factors and rational analytic methods. In so doing, it largely overlooked the vital qualitative, power-behaviour factors and emergent organizational processes actually involved in the 'human activity' of manufacturing strategy development. The 'emergent organizational action view' of strategy development, as discussed earlier, has long been supported in the business strategy literature. By studying firms using a context-embedded and longitudinal design, researchers have provided important insights to how cultural, political and social factors influence the paradigm of strategy development rather than the unitary effect of deliberate rational planning processes (see Chapter 4 for details). As Anderson et al (1991) suggest that there is much less emphasis in the existing paradigm on a "synthetic" perspective for guiding management in making strategic manufacturing decisions. However, as indicated from the critical literature review, there appears to have been only few attempts to undertake empirical investigations into the integrative (deliberate/emergent) paradigm of manufacturing strategy development. This view has been supported by Swink and Way (1995)'s review of the literature in which (p.116) they typify this when they call for more "basic descriptive research on how manufacturing strategy is actually conceived and developed [especially] ...to test whether ...Skinnerian paradigm adequately portrays practice."

As addressed explicitly in two recent special issues of the Journal of Operations Management¹, this call is still largely unanswered. Such concern has been expressed clearly in the paper of St. John *et al.*, (2001) "Change Drivers for the New Millennium: Implications for Manufacturing Strategy Research". The authors have suggested a critical need of empirical studies that take a contingency approach and focus on exploring and conceptualising the integrative paradigm of manufacturing strategy development which is practiced by the high performing industrial organizations in a wider social, cultural, and political setting of the business. This, as indicated by the authors, will provide broader contextual contingencies for the refinement and future development of analytic methods and decision aids for developing manufacturing strategy. They also advocate the configuration research as a promising avenue for such development.

Methods for conducting configuration research in relating managerial phenomena to their embedded context, namely in studying the 'contingency thesis', are already well established in other disciplines of social and organizational science. The underlying conception and methodological implication of configuration research had been presented extensively in both Chapter 3 (section 3.3.1) and Chapter 4 (section 4.2.3). In general, as Miller and Mintzberg (1983) noted, the configuration approach yields a systematic, multidimensional, and holistic image of the social reality, without attributing causation to any of the individual parts of the whole. The distinguishing characteristic of configuration models, as they suggested, is the establishment of multidimensional profiles and an integrative perspective. These are well suited to the study of

¹ Journal of Operations Management, Volume 19, Issue 2, Pages 129-256 (February 2001)
Journal of Operations Management, Volume 18, Issue 6, Pages 601-737 (November 2000)

holistic, interdependent, and context-embedded managerial phenomena in describing the actually paradigm of strategy development (Miller, 1983). The prime thesis of the configuration research in relating strategy development practice to its context, as Miller (1986, p.235) suggests, is that strategy development practice and its embedded context often coalesce or configure into a manageable number of common, predictively useful types that characterise a large proportion of high-performing organizations. The configurations (or 'gestalts', or 'archetypes', or 'generic types') are said to be predictively useful in that they are composed of tight constellations of mutually supportive elements. Thus, each element makes sense in terms of the whole - and together they form a cohesive system (Miller and Friesen, 1984, p.22). The presence of certain elements can thus lead to the reliable predictions of the remaining elements (Miller and Mintzberg, 1983).

This thesis considers the case of China, and the empirical work underpinning this thesis was conducted in China. As China gradually becomes integrated into the world economy, the relevance of Western management models becomes a practical matter as much as a theoretical issue (Peng and Heath, 1996; Shenkar and von Glinow, 1994; Tan and Litschert, 1994). Since China markedly differs from Western countries in terms of culture, society, and political and economic systems, it potentially represents the most serious challenge to the managerial paradigm and management theories developed and empirically tested primarily in the West. It thus presents promising grounds to test and refine existing management theories and to develop new ones with greater contextual contingency and wider theoretical perspective (Peng and Heath, 1996; Tan and Li, 1996; Shenkar and von Glinow, 1994).

China's economy has undergone a dramatic transformation during the last decade. Most prominent in this process have been the restructuring of SOEs and the surge in foreign direct investment. And a great deal of increasing contemporary international interest is focused on the process of the organizational transformation of SOEs. In broad terms, China's ongoing programme of enterprise management reform has aimed at giving SOEs progressively greater autonomy at the firm level from the government, especially in the areas of marketing, production and capital investment, while also forcing them to take more responsibility for their own profits and losses and to be more responsive to market signals in their business operations. The Chinese Communist Party's 15th Congress in September 1997 decided to convert SOEs into shareholding companies. Establishing an effective governance system was regarded as one of the most important objectives of the reform. Particularly since the start of the Modern Enterprise System (MES) and Group-Company System (GCS) reforms, this transition from near-total dependence on the state to a much more autonomous and market-oriented mode of business operations has been referred to as the "corporatization" of large SOEs. Historically, Chinese managers have little or no involvement in the development of corporate, business, marketing, finance, and manufacturing strategies. Now there is an increased recognition that strategic management activities such as these are the very essence of management task for managers of manufacturing companies in the same way as they are for their counterparts in the Western economies. In the case of SOEs in China, the types of manufacturing structures, more specifically

infrastructures such as production planning/control, work organizations, and the set of production capabilities developed under the command economy, are often inappropriate to satisfy the emergent free market. The strategic management of manufacturing within the changing business context in general and the development of effective manufacturing strategies at the firm level in particular, as Forrester and Hassard (2000, p.426) suggest, are therefore essential to achieve the goal of SOE reform and ensuring enterprises' long-term competitiveness. They also pointed out that some theory and 'best practice' prescriptions emerging from the Western operations management literature is particularly relevant for China's SOEs. Notably the concept of 'manufacturing strategy' has particular relevance to Chinese situation. However, Western manufacturing strategy literature as reviewed above often displays a rather naive and unitary perspective of the nature and paradigm of strategic decision-making, one that largely overlooks the context-embedded emergent factors and the social/political influences on the development of manufacturing strategy.

In the chosen population of this research – large-scale SOEs in China's petrochemical industry - the theoretical limitations of the existing paradigm of manufacturing strategy development have emerged to be more critical than what has been reported in the Western literature. Through "pre-research" field investigations, the author discovered that although the underlying concept of strategic manufacturing management had been widely adopted by local management, the Westernised Skinnerian paradigm and its methodologies for developing manufacturing strategy are very limited in the extent to which they could explain and contribute to the high quality of strategic thinking and decision-making practiced in the local context. This finding has been in line with the previous arguments of Forrester and Hassard (2000) and Hassard et al., (1999) that contemporary Western management literature and analytical frameworks only provide a partial explanation of the strategic manufacturing management practice in China. It also has been confirmed by a recent survey research published in the *European Management Journal* conducted by Pyke *et al* (2000). They pointed out that SOEs were far more involved and advanced in using explicit competitive and manufacturing strategy concepts than had been anticipated and the manufacturing strategy development practice is also far more complex, intertwined, multifaceted and context-specific than had been reported in the Western literature.

The exploratory nature of this project has been, therefore, justified from both the critical literature review and the pre-research field investigations (see Chapter 3 section 3.3 for details). From this it is clear that there have been only few previous studies on the subject of 'contemporary management paradigm of manufacturing strategy development' in the literature both English and Chinese (see Chapter 3, section 3,6 for details). The levels of uncertainty and general ignorance about the phenomenon in question are at their highest level and current perspectives on the subject emerged to be inadequate. None of these few previous studies was taking a configuration approach and there is no published research, at least no direct studies, on the subject has been done in the chosen population of the thesis (see Chapter 3, section 3.7 for details).

1. 4. Scope of the Research

Research Topic

Strategic Manufacturing Management in Contemporary SOEs within China's Petrochemical Industry



Theoretical Thesis & Theoretical Approach

Using configuration approach to study the manufacturing strategy development practice (its content & its process) in relation to its embedded context and analyse the performance implications of associations between the two.



Central Phenomenon under Investigation

Paradigm of Manufacturing Strategy Development
managerial interpretations & perceptions applied during the practice when operationalising the underlying concepts of strategic manufacturing management



Subject of the Study

Investigate Empirical Specifics and Management Perceptions of the Overall Context of Manufacturing Strategy Development

Investigate Empirical Specifics and Management Perceptions of the Manufacturing Strategy Content

Investigate Empirical Specifics and Management Perceptions of the Process of Manufacturing Strategy Development

- Abstraction Level 1 - Overall Paradigm
- Abstraction Level 2 - Process Patterns



by which the development of manufacturing strategy is organized

The goal of the research is:

To provide a wider contextual contingency and an integrative perspective for the paradigm of manufacturing strategy development from empirical studies conducted in contemporary industrial companies in China, which could be used for the refinement and future development of context-specific analytic methods and decision aids when operationalising the concept of strategic manufacturing management.

The aim of the research is:

To provide in-depth understanding into the *successful experiences* of managing manufacturing strategy development from SOEs within China's petrochemical industry regarding empirical specifics and managerial perspectives on its embedded context of consideration, its content configuration, and its process organization.

The Chief Research Questions are:

1. What are the empirical specifics and managerial perceptions about the overall context of manufacturing strategy development in SOEs within China's petrochemical industry?
2. What are the empirical specifics and managerial perceptions about the content of manufacturing strategy in SOEs within China's petrochemical industry?
3. What are the empirical process patterns by which the development of manufacturing strategy is organized in SOEs within China's petrochemical industry?
4. What are the empirical overall paradigms by which the development of manufacturing strategy is organized in SOEs within China's petrochemical industry?

And the objectives of the research are:

1. To develop an empirical configuration for conceptualising context-embedded specifics and managerial perceptions on the overall context of manufacturing strategy development in SOEs within China's petrochemical industry.
2. To develop a content configuration of manufacturing strategy in SOEs within China's petrochemical industry for generating context-embedded understanding regarding the empirical specifics and managerial perceptions on "competitive priority" of manufacturing and related "key strategic manufacturing decisions" in putting together desired manufacturing structure, infrastructure, and set of specific manufacturing capabilities.
3. To develop an empirical process configuration for conceptualising the context-embedded specifics and managerial perceptions on process paradigm and patterns of manufacturing strategy development in SOEs within China's petrochemical industry.

1. 5. Overall Research Design and Framework of Analysis

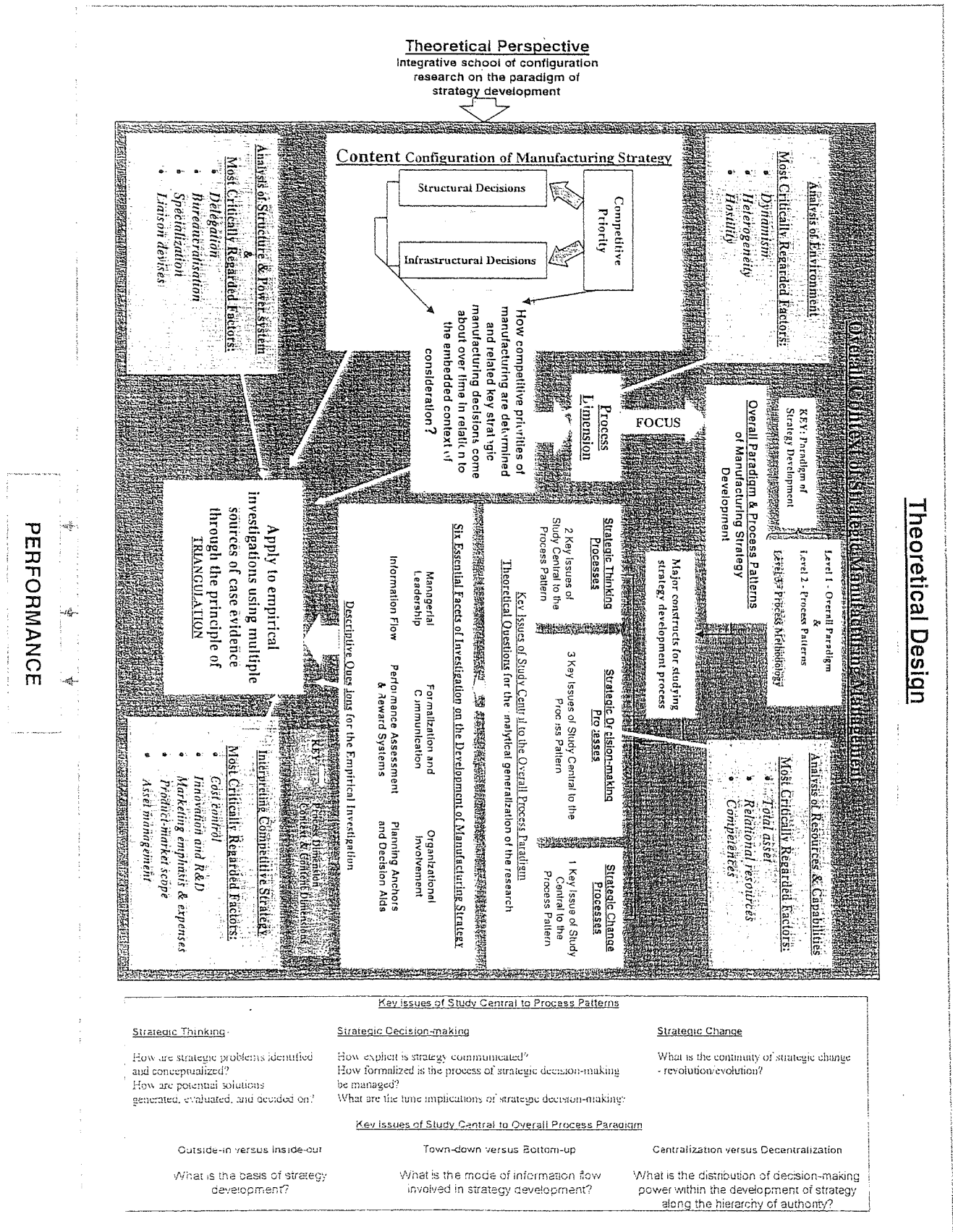
On the basis of theoretical thesis and research questions of the study, a case study method has been chosen as the research strategy for the given reasons presented later in Chapter 3 and Chapter 5 respectively. Upon the aim, focus, and central issue of the study, qualitative evidence has been chosen as the primary data source for the research for reasons that presented in Chapter 5 (see section 5.3 for details). Therefore, this research comprises qualitative case studies.

Given the exploratory nature and qualitative focus of the study, the research design should be essentially "inductivist" as many social anthropologists and phenomenologists suggest (see Chapter 5, section 5.2 for details). However, as Miles and Huberman (1984) and Eisenhardt (1988) suggest, within case studies, there are always both 'inductive' and 'deductive' aspects that call for the integrative perspective from researchers to effectively configure them together. This provides one point of difference between case studies and related field methods such as ethnography (Lincoln and Guba, 1985; Van Maanen, 1988; Van Maanen et al., 1982). More specifically, if one's project involves multiple cases or one's objective is to provide freshness in perspective to an existing research topic, as for both is the case in this study, necessary "front-end" preparation is crucial (Eisenhardt and Bourgeois 1988; Yin, 1994). A well-formulated research design will help the researcher to have a clearly-defined scope and perspective of the study, and to overcome researcher's bias and lack of rigor, and to provide convincing support for comparative analysis and theoretical generalization. However, given the exploratory nature of the study, what is planned for the research design is deliberately 'half-scripted' or 'semi-structured'. It is essentially serving as guidelines for the author to cover important aspects and facets of the investigation on the phenomenon that are most critically regarded in the literature. The subsequent operations and applications in the field, therefore, is sufficiently open and largely improvised by the author for the best possible exploration of the context-embedded configuration of the phenomenon. To recap, this study adopts a qualitative exploratory case study approach with 'semi-structured' 'front-end' research design (see Chapter 5, section 5.1 for details).

The 'framework of analysis', as Yin (1994, p.22) suggests, explains, (either graphically or in narrative form) the main things to be studied within the scope of the research and the angle of research to be applied for studying them. In other words, it defines the 'theoretical perspective' and 'theoretical design' for empirical studies. Given the critical deficiency of a multidimensional and integrative profile in the existing paradigm from a theoretical perspective identified earlier, the author follows the suggestion from many others (Adam and Swamidass, 1989; Ward et al., 1990; Minor et al., 1994; Amundson, 1998) to integrate concepts, constructs, and essential facets of investigation from the business strategy literature to study the management paradigm of strategy development for manufacturing. The construction of framework of analysis is presented in a very detailed narrative form in Chapter 4 and neatly summarized in Chapter 5. The following chart illustrates graphically the framework of analysis (see Figure 1.4) Of special note a great deal of

attention has been given to the "synthesis" of the 'three dimensions' of strategy development practice - its embedded *context* of consideration, its *content* configuration, and its *process* organization.

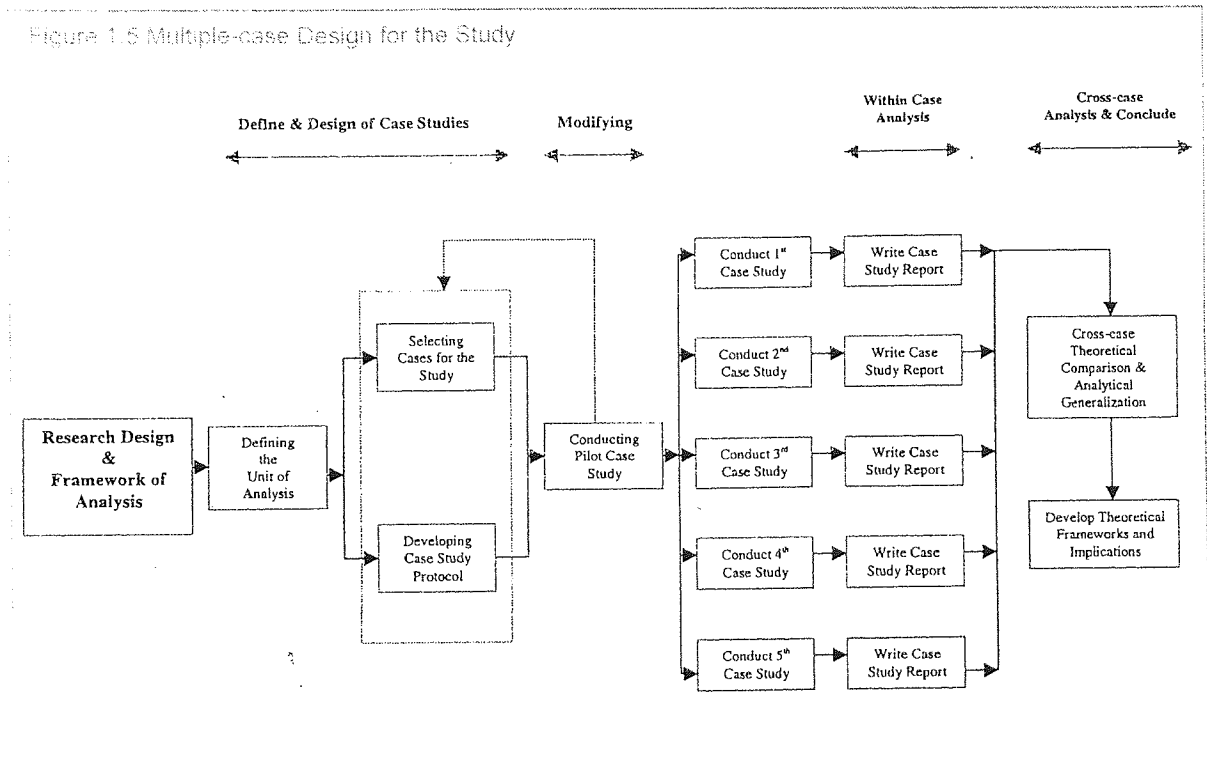
Figure 1.4 Framework of Analysis for the Research (as Figure 5.1)



1. 6. Multiple-case Design and Methodology for Empirical Investigations

Following the overall research design and framework of analysis, in conducting empirical investigations this study has applied an embedded multiple-case design to address the concern for a deeper understanding of the cases, better chance to explore, delineate, explain locally embedded configurations, and better precision, validity, reliability of the research findings. The following chart set outs graphically the multiple-case design applied:

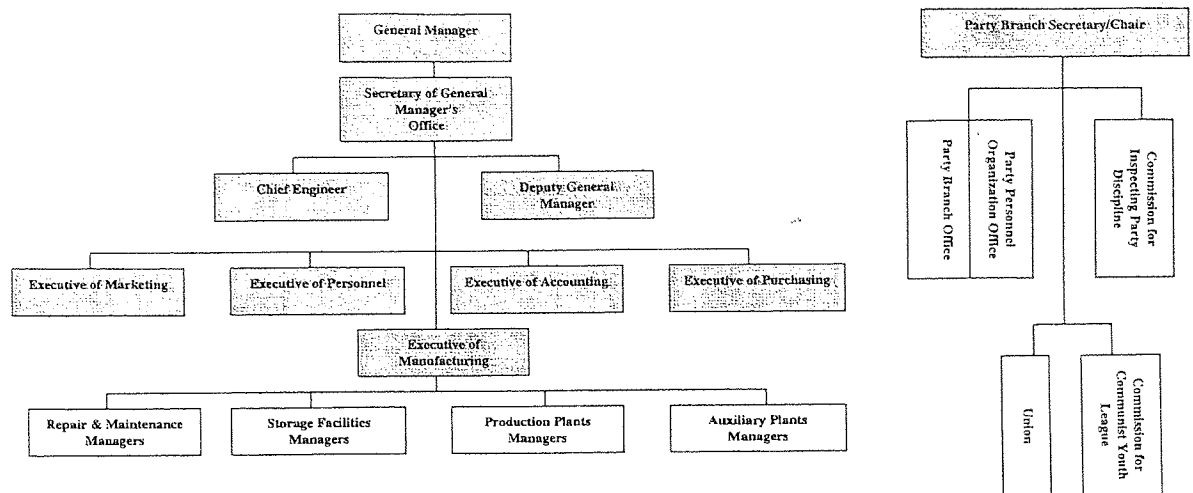
Figure 1.5 Multiple-case Design for the Study



The detailed clarifications of this multiple-case design and related methodological details are presented in Chapter 5 (see section 5.2.4 for details). In short, first the 'unit of analysis' for the research has been clearly defined as the SBU level of the firm. Then, specific 'time boundaries' of the research are defined with beginning of the case as GCS/MES reform experiments in 1997 and the end of the case in late year 2000. This followed by statement of reasons for choosing large-scale SOEs in China's petrochemical industry as the 'population' of the research. Through applying the logic of 'theoretical sampling' for cases, this project has chosen Yanshan as the 'sample' from the research population according to three theoretical criteria – it is a typical, a critical, and a successful case in the strategic management of business operations in general and manufacturing strategy development in particular. Given the unit of analysis defined earlier, five SBU divisions in the core petrochemical business of Yanshan were chosen as 'case companies' in this study in which the development of manufacturing strategy is independent event occurred in each of them. They are the Ethylene Division, Polypropylene Division, Polyester Division, Basic Chemical Division, and Synthetic Rubber Division. Within-case sampling has been carried out in the light of Fine and Hax's (1985) model of integrating manufacturing decision-making into the strategic context of business. In this project, within-case sampling has also been investigative.

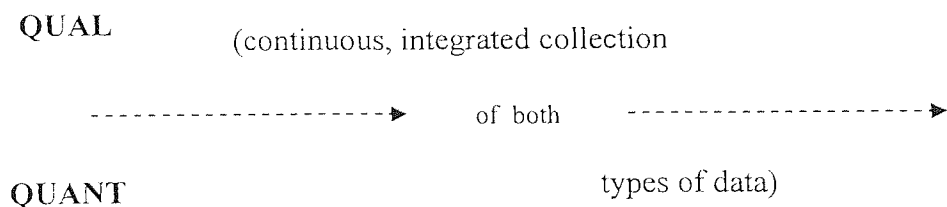
The author started with essential role partners and interactions addressed by the above sampling model. While interviewing, observing, and picking up documents, empirical evidence leads investigation to new respondents, observations, and new documents needed to be included for deeper locally grounded explorations. So sampling in this way helps the author to see a contextual configuration in more 'depth'. The within-case sampling framework is finalized after the pilot case study and its details set out by the following chart:

Figure 1.6 Within-case sampling at Yanshan (as Figure 5.3)



Related methodological details for the empirical investigation have been formulated in a case study protocol devised by the author. It contains 'sources of empirical evidence' from which data would be collected, 'instrumentation of ways and procedures' with which data would be collected, and also 'general rules' that would be followed in the process of data collection. In short, research data has been collected through four major sources of case evidence – qualitative interviews (semi-structured/focused), direct observations, documentations, and archival records. Two principles applied to the data collection process are 'triangulation' and 'overlapping data collection and data analysis'. Of special note to the convergence of multiple sources of case evidence is the combing of 'qualitative' with 'quantitative' evidence. In this study, the fieldwork has involved steady, integrated collection of both quantitative and qualitative data (see Figure 1.7). Only when all of the evidence has produced a consistent picture was the author satisfied that the particular strategy development practice studied has actually occurred in a certain manner discovered.

Figure 1.7 Design for Linking Qualitative and Quantitative Data (as Figure 5.5)



1. 7. Summary of Main Research Findings

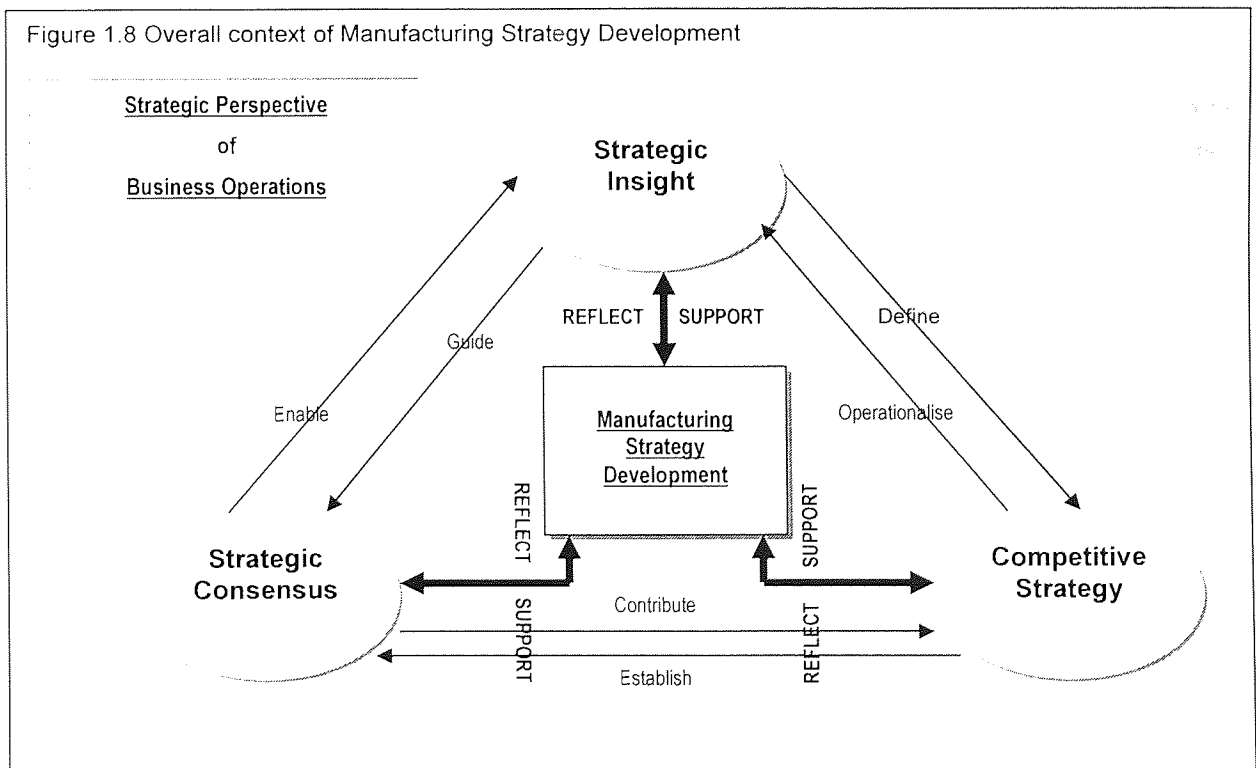
From Skinner (1969) to more recent times (e.g. Hayes and Upton, 1998; Boyer and McDermott, 1999; Ward and Duray, 2000), many leading scholars in the field have emphasised the importance of manufacturing strategy in achieving corporate success. This study examines the underlying concept of strategic manufacturing management in the context of Chinese SOEs, its perception regarded by the local management and theoretical issues raised when operationalizing it during the practice. This study presents an exploratory analysis of empirical data from five embedded in-depth case studies in China's petrochemical industry. There are a number of insights from this study that can be used to assist in further understanding the contemporary management paradigm of developing manufacturing strategy i.e. towards its context of consideration, its content configuration and its process organization, which is actually practiced by the high performing industrial organizations in a wider social, cultural, and political setting of the business.

First, the study results lend empirical validity to the underlying concept of strategic manufacturing management in the context of Chinese SOEs.

- The role production function plays at case companies is larger than just that of implementer of business strategy; production function closely corresponds to the way in which case companies compete in the marketplace.
- Management at case companies regards development and exploitation of production-based competitiveness as the key to superior organizational performance.
- Manufacturing strategy adopted at case companies has contributed to the development and exploitation of production-based competitiveness on two major aspects:
 1. Manufacturing strategy directed case companies to a competitive edge along dimensions in production performance that are valued most by the evolving customer's needs and not yet being emphasised or satisfied by their competitors.
 2. Manufacturing strategy reflected and reinforced the above strategic direction with a dynamic perspective throughout the production organization to translate it into a consistent set of operating decisions, a tightly integrated system of supporting values, skills, techniques and workforce that is flexible in reacting to environmental changes.

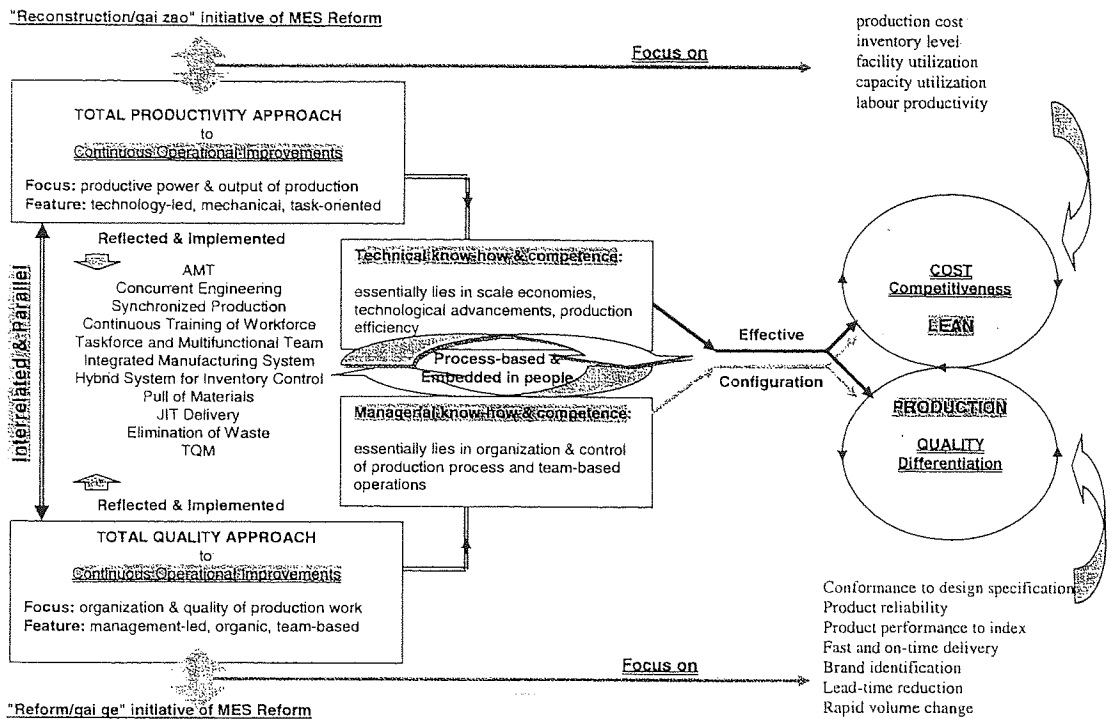
Second, the study results indicate a multidimensional and integrative profile from a theoretical perspective regarding how the deliberate and emergent management mindset and processes actually act together to realize a successful manufacturing strategy in building and improving the production-based competitiveness at case companies.

- Managerial perceptions and interpretations towards the 'CONTEXT' of developing manufacturing strategy.
1. Strategic perspective of business operations at case companies brings together management's perception towards the four contextual aspects defined in the framework of analysis and integrates them into a holistic consideration for developing manufacturing strategy during the practice. This has been clearly illustrated in chapter 7 section 7.2.1 and thoroughly explained in chapter 8 section 8.2.1.
 2. Strategic Perspective of business operations at case companies, therefore, defines the overall context of strategic management at functional level in general and manufacturing in particular. Developing of manufacturing strategy, as widely acknowledged by the management, has to adequately operationalise and fully support this strategic perspective through the way it configures and improves the production system.
 3. Strategic perspective of business operations is reflected and made operational through three major aspects of management practices performed at case companies - creating strategic insight into the operating context, developing competitive strategy and establishing strategic consensus. Detailed analysis on these three aspects and their mutual interactions is presented in chapter 6 section 6.6 and chapter 7 section 7.2.2, upon which a configuration framework is devised to model the strategic perspective of business operations observed and in so doing to conceptualise the holistic context of manufacturing strategy development (see Figure 1.8 as Figure 7.6 and 8.1).



4. Theoretical implication from the above devised framework relates to the multidimensional and integrative scope of consideration practiced by case companies, which incorporates managerial understanding on market demands, industrial competition and organizational competence. This sheds new light on the actual management perceptions towards the 'context' of developing manufacturing strategy when compared to the rather overly market deterministic perspective advocated in the existing paradigm. Of special note is the development of 'strategic consensus' between competitive priorities addressed at corporate level and operating decisions made at functional level as a core component in achieving the effective balance between outside-in and inside-out approach at case companies (see Chapter 8 section 8.2.2 for details).
 5. Strategic perspective of business operations at case companies is configured and best characterised by a lean paradigm whereby there is the ongoing and simultaneous pursuit of multiple competitive priorities in both 'low cost competitiveness' and 'high quality differentiation'. This sheds new light on the level of generalisability of lean operations practice when applied to a case study that is, as in this research, quite different from the types of industries and business setting examined in previous studies (see Chapter 8 section 8.2.2 for details).
- Managerial perceptions and interpretations towards the 'CONTENT' of manufacturing strategy.
1. The aim of having a manufacturing strategy, as perceived by the management, is to configure and improve production system in such a way that it can provide case companies that form of lean competitiveness prioritised by the business operations most effectively. In so doing, the strategic role manufacturing plays at case companies is supportive in nature and reflected through a configuration of both internal and external contributions to the organizational superiority (see Chapter 7 section 7.3.1 for details).
 2. Manufacturing strategy, as the results indicate, provides a detailed 'roadmap' to operationalise and measure the adaptation of leanness in the context of production system (see Figure 1.9). The findings have been thoroughly explained in chapter 7 sections 7.3.2-7.3.4, which provide insight and theoretical implication in four key ways - competing through production competence, transforming the design and operation of production system, prioritising operational improvements and management constraints in improving production competence.

Figure 1.8 Manufacturing Strategy - a roadmap to production leanness



3. Instead of making short-term trade-offs among production capabilities, manufacturing strategy adopted at case companies takes a dynamic, competence-building driven approach as illustrated in the above graphical framework to align production system with the strategic perspective of business operations and demands of the emergent free market. This approach, as the results indicate, is widely disseminated and deeply felt by both managers and operators in the production organization through policy articulation and deployment. The outcome of this approach both in terms of technical and managerial know-how and competence is essentially process-based and embedded in the company's people.
4. The most direct tradeoffs presented by the design of production system under the command economy, as regarded by the management, involve design quality to unit cost and product mix to unit cost. Following the manufacturing strategy, transformation to a lean production at case companies is conducted through the continuous facility modifications and improvements in work organization, which are closely in connection to the 'gaizao' and 'gaige' initiatives of MES reform (see Chapter 7 sections 7.2.4 and 7.3.2 for details). At the heart of the transformation is the deployment of advanced manufacturing technologies, concurrent engineering and synchronisation in capacity expansion and technological advancement, continuous training of workforce in technical know-how and skills, taskforce and multifunctional team, integrated manufacturing system with multi-process/product and plant-in-plant layout.
5. In transition to the lean manufacturing, the central planned production quota and resources allocation system has been replaced by a market-oriented system at case

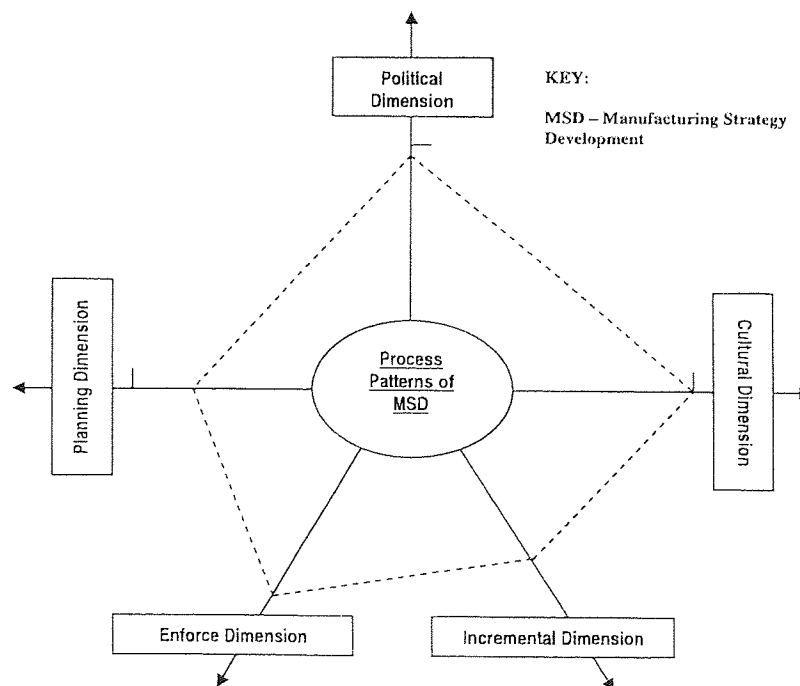
companies. It is, as results indicate, a hybrid system for production planning and inventory control. Production and demand at aggregate level is reconciled through the computer-based production requirement planning and scheduling (MRP), which is a forecast-based conventional push system. The 'real-time' control of material flow, production work and product delivery, however, is operating under an inventory-based JIT pull system. The results indicate that significant progress has been made regarding elimination of waste, reduce of inventory level and delivery performance since the introduction of this hybrid system.

6. The most essential operational improvement, as regarded by the management, is 'conformance' quality of product and production, which is closing up the gap between design quality specification and actual build quality. The scope of quality improvement is gradually extended to the 'reliability' and 'performance' quality of product and production. Through the implementation of TQM (see Chapter 7 sections 7.3.3 and 7.2.3 for details), case companies also start to address gaps between management's concept of quality and customer's specification of quality and design quality of product and production. Of special note, the significant improvement in quality performance is not gained at the expense of performance improvement in other production capabilities. Improvements in quality has proven to pay significant dividends in achieving dependable supply, flexible delivery and, most importantly, long run cost reduction through reducing defects, reworks and production inventory.
 7. Political influence and government interference has, as acknowledged by many managers interviewed, critically constrained the progress and strategic initiatives regarding reduction of surplus and incompetent workforce at case companies, particularly with management personnel (see Chapter 7 section 7.3.4 for details).
- Managerial perceptions and interpretations towards the 'PROCESS' of manufacturing strategy.
1. Research findings regarding this final objective are very tentative and represent only a sketch of the empirical process paradigm and patterns of developing manufacturing strategy currently practiced at case companies. However, given the exploratory nature of such investigation demonstrated and justified, the results are satisfactory at this stage of study into the subject.
 2. The development of business strategy and other functional strategies including manufacturing strategy is primarily organized at SBU level of the firm since the MES reform. A deliberate planning approach is clearly evident as the results indicated. Case companies all have certain form of standardised strategic planning procedures in place mainly derived from the 'gaizu' and 'gaige' initiatives of MES reform.
 3. During the deliberate planning process studied, case companies all adopted systematic approaches as part of their Management Information System (MIS) to

collect and process information on operating context both external and internal (see Chapter 6 section 6.6 for details). Theoretical implication derived from this observation relates to the strategic use of MIS in the context of production and the critical need for a MIS interfacing model to address the linkage between strategic initiatives and requirements for MIS.

4. During their interpretation of information collected, case companies all applied certain analytical tools as decision aids to assist with developing managerial understanding and creating strategic insight (see Chapter 7 section 7.2.1 for details). The application of these analytical tools from a methodological perspective goes beyond the defined scope of this study. However, it is an interesting finding that they have been commonly acknowledged, applied and, to certain extent, refined by managers at case companies. Future research is needed to further investigate their applications in developing manufacturing strategy, particularly the approach through which they have been configured and tailored to the local context of business operations in China.
5. Emergent features, as the results indicate, are also clearly evident therein the patterns by which the development of manufacturing strategy is organized at case companies. Cultural, political and enforced perspectives of decision-making are strongly supported by the results (see Chapter 7 section 7.4.2 for details). An important implication derived from this observation relates to the theoretical argument made by the author that the dominant Skinnerian paradigm of top-down deliberate planning approach from the existing literature only provides a partial explanation of contemporary strategic manufacturing management practice in China (see Figure 1.10 as Figure 7.9 and 8.3).

Figure 1.10 An Integrative and Multidimensional Profile of Manufacturing Strategy Process

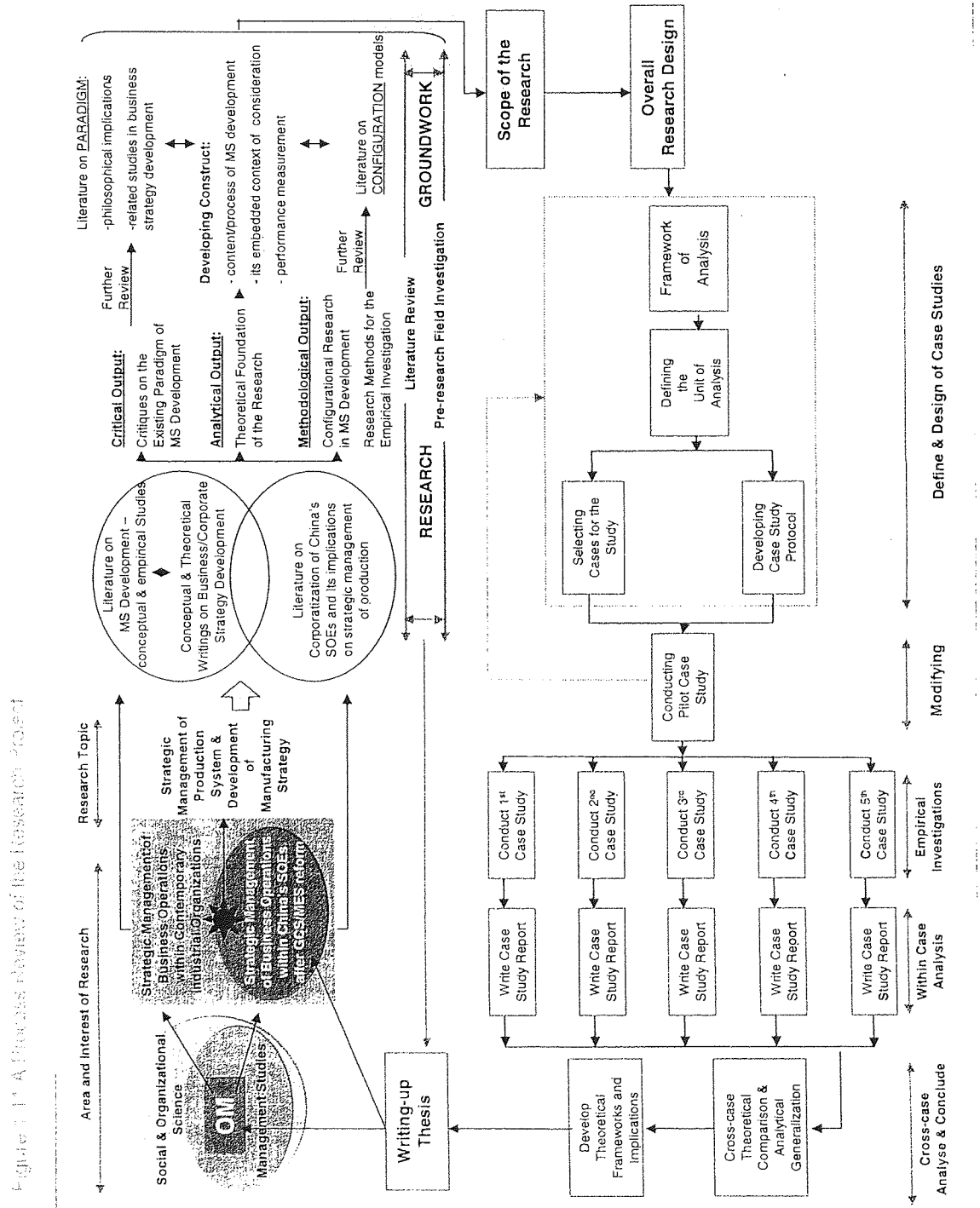


6. 'Formalization and communication of strategy' and 'managerial leadership within the decision-making process' are singled out by case companies as the most significant aspects to reflect a changing paradigm of manufacturing strategy process over the past five years into MES reform and restructuring.
7. The results indicate that top-down hierarchical neatness is not supported by the evidence at case companies; neither a bottom-up autonomous mechanism of decision-making is evident. The overall paradigm of manufacturing strategy process is best characterised as 'middle-up and down', in which the core of management style is not senior managers at the top or the autonomous operators at shop floor, but rather the 'functional executives' in the middle. This observation is also strongly supported by the results regarding changes in managerial leadership at case companies (see Chapter 7 section 7.4.1 for details).
8. The rationale behind such emergent distribution of decision-making power, as regarded by the management, reflect case companies' effort to minimise costs of lack of information for both strategic macro at the top and hands-on micro at the bottom during decision-making and to stimulate strategic consensus between corporate centre and workforce regarding the linkages between competitive priorities and resulting operational decisions (see Chapter 7 section 7.4.3). Despite the implicitly accepted need for strategic consensus in the literature, there has been relatively little empirical appraisal of consistency or otherwise difference between managers and operators at different levels of the manufacturing organization (see Chapter 3 sections 3.6-3.7 for details).

Finally, drawing on the author's experiences in this study, several reflections on the implementation of case study research approach are aimed at helping future researchers make a more informed methodological choice for investigating the subject. It is conceived from an essentially pragmatic standpoint, from the perspective of someone considering such research to gain a better understanding and deeper insight into the subject of 'the contemporary management paradigm of developing manufacturing strategy in Chinese SOEs in practice' (see Chapter 8 section 8.5 for details).

1. 8. Conclusion

Through the foregoing seven sections, this introductory chapter presents a surgical and thoughtful overview of the research project in terms of its essential constructs or major 'skeleton' of CONTENT. In this concluding section the author is to provide a graphical representation of the PROCESS of the research project, which includes all the working stages and methodological procedures in the course of completing the thesis (see Figure 1.11).



2. Philosophical Basis of the Research

2. 1. Introduction

In the most elementary sense, this project comprises a research on management of the organization that rooted essentially in the social and organizational sciences (Lupton, 1971). Its concern is primarily with macro/micro – organizational behaviour, and the activity and interactions of *human beings*.

As a research subject, management is multidimensional in nature. Drucker (1974, p14) notes that management denotes both a function and the people who discharge it. It denotes a social position and authority, but also a discipline and a field of study.

First, management is about *tasks*. There are three tasks – equally important, strongly related, and essentially different – that face the management of every institution:

- **To think through and define the specific purpose and mission of the institution.**
- **To organize and make the process of work productive and the worker achieving**
- **To manage social impacts and social responsibilities.**

Drucker (1974, p.36)

Second, management is a *discipline*. It is an organized body of knowledge – the whole set of rules comprising - know-“what”, know-“how”, know-“where”, know-“when”, know-“who” and insights of know-“why”, that contribute to the practice of management as a profession as the problems and needs arise (Drucker, 1974, p.10).

Third, management is fundamentally about *people*. Every achievement of management is the achievement of a manager. Every failure is the failure of a manager. People manage, rather than “forces” or “facts”. The perspective, vision, dedication, and integrity of managers determine whether there is management or mismanagement. As Drucker (1974, p.20) notes that the essential work of a manager is to make decisions and execute them – decisions on “what” and “how” based on reasoning “why” in the context of “where”, “when”, and “who”. Decisions are commitments to action. Actions are the one and only way to positively forge the future. There are five basic operations in the work of the manager within which decisions are regarded. Together they result in the integration of resources into organizations as viable growing organisms:

1. **A manager makes decisions to set objectives.**
2. **A manager makes decisions to organize.**
3. **A manager makes decisions to motivate and communicate.**
4. **A manager makes decisions on measurement.**
5. **A manager makes decisions to develop people, including himself or herself.**

2. 2. The Fundamental Goal of Management Research

“A central mission of scholars and educators in professional schools of management, health, education, and social work is to conduct research that contributes knowledge to scientific discipline, on the one hand, and to apply that knowledge to the practice of management as a profession, on the other.”

(Simon, 1967, p.3)

From sociology, Reynolds (1971) notes that the fundamental goal of any researcher or any research effort is to create scientific knowledge. He also defines the elements and functions of scientific knowledge. Scientific knowledge would ordinarily be viewed as a broader category of knowledge, with theory comprising one element of it (see Figure 2.1). Scientific knowledge, defined by de Wit and Meyer (1998, pg.199), is the whole set of rules (know-“what”, know-“how”, know-“where”, know-“when”, know-“who”) and insights (know-“why”) that can be extracted from and help make sense of, information.

Figure 2.1 Essential Elements of Scientific Knowledge

Aston University

Illustration removed for copyright restrictions

Adopted from Reynolds (1971)

In the context of this research, as defined clearly in the previous chapter, the goal here is to gain a better understanding and deeper insight into the subject of 'contemporary management paradigm of developing manufacturing strategy in Chinese SOEs in practice. That is to know-"what" is the actual management activity (practices & perspectives), know-"how" such activity is organized and carried out and finally know-"why" it occurs in the way it does particularly in view of the existing understanding from the literature. Because basic descriptive research has been called to provide such empirical understanding required on the subject, it is necessary to emphasis that besides theory scientific knowledge includes non-theoretical knowledge such as descriptions and predictive models. As Hempel (1965)

pointed out, the vocabulary of science has two basic functions: (a) to adequately describe the objects and events being investigated and (b) to establish theories by which events and objects can be explained and predicted.

While *description*, the “feature or qualities of individual things, acts, or events”, are not themselves theoretical statement, the notion of *description* is an important basic knowledge-generating concept and source material of theories. *Categorizing phenomena* is a valid and important scientific endeavour (Werkmeister, 1959, P.484). Bacharach (1989) states that there are three modes of description: *data*, *categorization systems* (taxonomies and typologies), and *metaphors*. In the organization and management literature especially, categorization systems of description (taxonomies and typologies), are often confused as theoretical statements. As Bacharach (1989, p.497) notes, *categorization* characterizes much of the work in these two fields, particularly in the realms of business strategy and human resource strategy. One theme in the former case, for example, has been the search for empirical categorizations, or “gestalts”, of organization environments and operation’s characteristics (e.g., see Miller, 1986; Miller and Friesen, 1977). One characteristic in the latter case has been the search for “a goodness of fit” between empirically derived categorizations of business strategy and human resource strategy (e.g., Schuler and Jackson, 1987; Wils and Dyer, 1984). These studies, both quantitative and qualitative, are often particularly rich and useful grounds for theory building (e.g., see Glaser and Strauss, 1967; Miller, 1987; Miller and Friesen, 1984). In and of themselves, however, *taxonomies* and *typologies* fall in Hempel’s (1965) realm of description, not *theory*.

Categorization, such as the classification and placement of species in the field of biology, is not viewed as *theory*, but constitutes one of the predecessor or elemental activities required before a theory can be constructed. Categorization is the *fundamental building block* of defining concepts, which is a necessary *precondition* for theory construction. Likewise, several other types of scientific knowledge are necessary preconditions for theory building and support construction of theory.

Reynolds (1971) discusses the roles of prediction of future events, explanation of past events, and control of phenomena within the domain of scientific activities. While predictive capability is ordinarily viewed as a characteristic of a good theory (Bacharach, 1989), it is possible to create predictive models with strong forecasting capabilities that are not viewed as theories. Theorists emphasize that explanation and the potential for control of a phenomenon are ultimate goals for strong, well-developed theory. While it is not possible to reach the goal of control of many phenomena, the contribution of explanation and Reynolds’ “sense of understanding” (1971, p. 4) are often extremely valuable.

Reynolds (1971) lists several purposes of scientific knowledge (see table 2.1). This defines the domain of *scientific inquiry*, permitting the comparison of theory with the wider set of elements included in scientific knowledge. Fundamentally, the purpose of theory as comprising elements of scientific knowledge is to *define, establish, and explain relationships between concepts of phenomena observed and described*. Therefore theory development and theorizing constitute a subset of the wider set of knowledge construction activities in which researchers engage (Reynolds, 1971).

Table 2.1 The Purposes of Scientific Knowledge

1. **A method of organizing and categorizing 'things', a taxonomy or typology**
2. **Predictions of future events**
3. **Explanations of past events**
4. **A sense of understanding about what causes events**
5. **The potential for control of events**

Adopted from Reynolds (1971)

Again, as mentioned at the beginning, the central mission of management researchers is to conduct research that contributes knowledge to the scientific discipline of management and applies that knowledge to the practice of management as a profession. To do this well, one needs to design the research so that it provides an intimate understanding of the practical problems facing the profession in the field. Equally important, one needs to appreciate and strengthen skills in developing good theory so that research conducted will advance the knowledge that is relevant to both the discipline and the profession.

2. 3. The Building Blocks of Management Theory

According to theory-development authors (e.g., Dubin, 1969), a complete theory must contain four essential elements, which address each of the following questions:

“What”. What factors (concepts and constructs) logically should be considered as part of the explanation of the social or individual phenomena of interest?

“How”. Having identified a set of factors, the research’s next question is “how are they related?” Operationally, this involves using “arrows” to connect the “boxes”. Such step *maps and adds order to the conceptualisation by explicitly delineating patterns*. In addition, it typically introduces abstract causality. Although the researcher may be unable to adequately build and test concrete relationships and structure of these links, restrictions in methods and samples do not invalidate the inherent causal nature of theory.

Together the “What” and “How” elements constitute the *domain* of the theory. The more complex the set of relationships under consideration, the more useful it is to graphically depict them in terms of formal models.

“Why”. Why do relationships occur as they do? What are the underlying psychological, economic, or social dynamics that justify the selection of factors and the proposed causal relationships? This rationale constitutes the theory’s assumptions – the theoretical glue that welds the model together. The central question addressed here is: Why should we give credence to this particular representation of the phenomena? The answer lies in the logic underlying the model. The soundness of fundamental views of human nature, organizational requisites, or societal processes provides the basis for judging the reasonableness of the proposed conceptualisation.

To summarize thus far: “what” and “how” describe; only “why” explains. “What” and “how” provide a descriptive framework for interpreting and conceptualising patterns or discrepancies in our empirical observations. Together these three elements, “what”, “how”, and “why”, provide the essential ingredients of a simple *theory* - description and explanation.

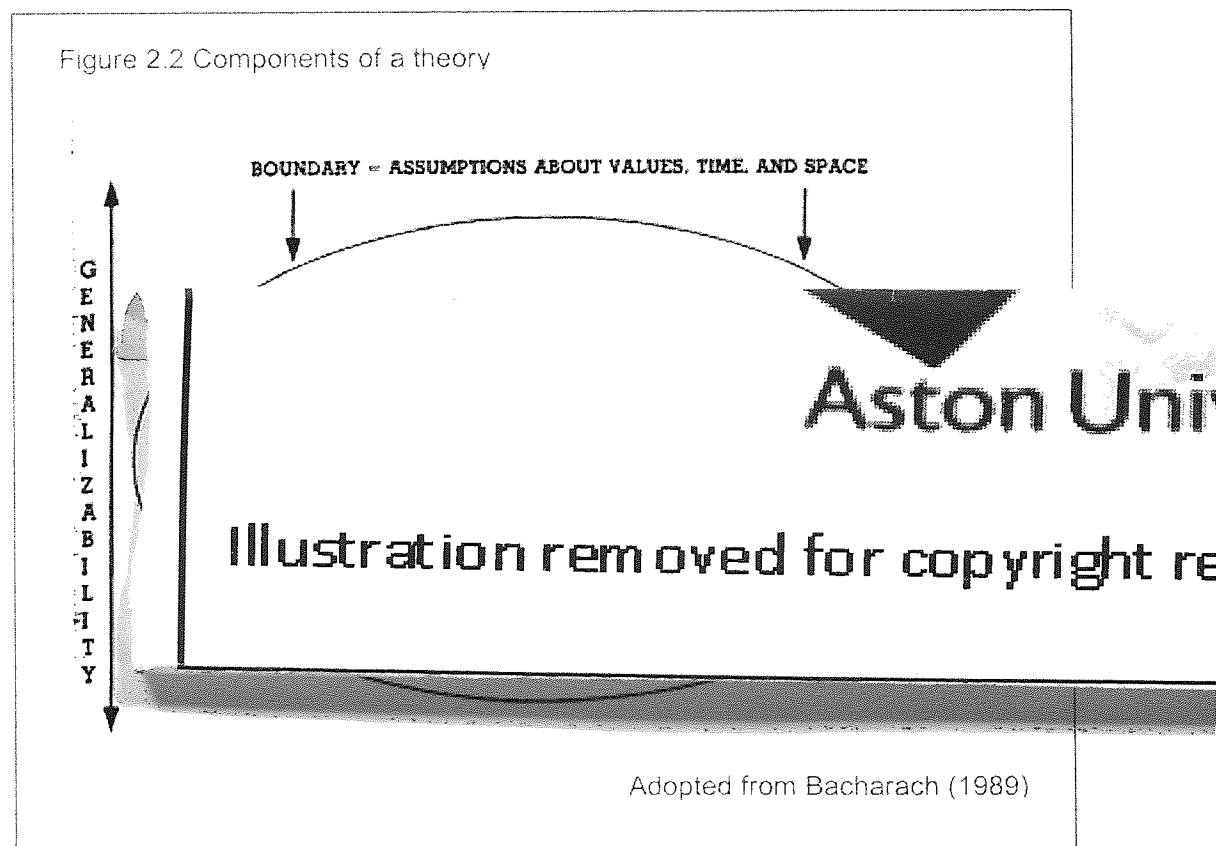
“Where”, **“When”**, and **“Who”**. These conditions place limitations on the propositions generated from a theoretical model. These temporal and contextual factors set the boundaries of generalizability, and as such constitute the range of the theory. Unfortunately, few theorists in organization science explicitly focus on the contextual limits of their

propositions. In their efforts to understand a social and organizational phenomenon they tend to consider it only in familiar surroundings and at one point at time.

According to the contingency thesis of this research meaning is derived from context. That is, we understand 'what' is going on, 'how' and 'why', by appreciating 'where' and 'when' it is happening. Observations are embedded and must be understood within a context.

Building on the previous works of theory development (e.g., see Dunin, 1969 and 1976; Negel, 1961; Coehn, 1980), Bacharach (1989) defines a *theory* as a *statement of relationships between units observed or approximated in the empirical world*. Approximated units mean *constructs*, which by their very nature cannot be observed directly (e.g., centralization, satisfaction, or culture). Observed units mean *variables*, which are operationalised empirically by measurement.

In more detailed terms, a theory may be viewed as a system of constructs and variables in which the constructs are related to each other by propositions and the variables are related to each other by hypotheses. The whole system is bounded by the theorist's assumptions, as indicated by Figure 2.2



The notion of boundaries assumptions based on is critical because it sets the limitations in applying the theory as mentioned earlier. As Dubin (1969) notes, all theories are constrained by their specific critical bounding assumptions. These assumptions include the implicit values of the theorist ("who") and the often explicit restrictions regarding place ("where") and time ("when").

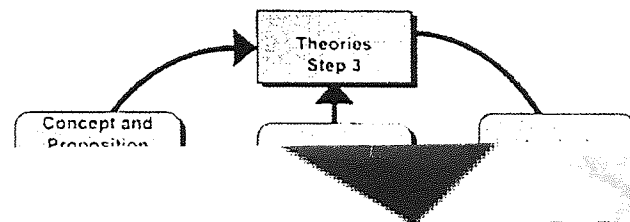
Within these boundaries lies the stuff of theory. On a more abstract level, propositions state the relations among constructs, and on the more concrete level, hypotheses (derived from the propositions) specify the relations among variables. Constructs may be defined as "terms which, though not observational either directly or indirectly, may be applied or even defined on the basis of the observables" (Kaplan, 1964, p.55). A variable may be defined as an observable entity which is capable of assuming two or more values (Schwab, 1980). Thus, a construct may be viewed as a broad conceptual configuration of given phenomenon, while a variable may be viewed as an operational configuration derived from a construct.

Created within the context of specified boundaries and built from abstract constructs or their more concrete manifestations (variables), theoretical systems take the form of propositions and proposition-derived hypotheses. While both propositions and hypotheses are merely statements of relationships, propositions are the more abstract and all-encompassing of the two, and therefore relate the more abstract constructs to each other. Hypotheses are the more concrete and operational statements of these board relationships and are therefore built from specific variables.

2. 4. Theory Development Paradigms

In this section the author is going to consider more closely how theories are developed in view of philosophical models. Researchers have noted over the years that there exists no common series of events that unfold in the scientific process of theory development. However, several leading philosophy of science scholars have identified a number of common themes within the theory development process. The most common of these was stated by Bergmann (1957, p. 31), and reiterated over the years by many others (Popper, 1961; Kaplan, 1964; Stinchcombe, 1968; Blalock, 1969; Greer, 1969): 'The three pillars on which theory is developed are observation, induction, and deduction'. This school of thought was later summarized into a series of elements and first mapped by Wallace's (1971, p.17) *scientific theory development model* (see Figure 2.3). The map provides a useful reference in identifying the different stages that *must* occur in the theory development.

Figure 2.3 Scientific Theory Development Model



Aston University

Illustration removed for copyright restrictions

Adopted from Wallace (1971)

The *top half* of the model represents what is often referred to as *theorizing*, via the use of inductive and deductive logic. The *bottom half* represents what is commonly known as *doing empirical research*, with the aid of prescribed research methods.

The **right half** of the model represents what is meant by the *deductive application of theory to observation – theory verification*. A deductive research paradigm entails the development of a conceptual and theoretical structure prior to its application and testing through empirical observation (Gill and Johnson, 1991, p. 28). The theory or problem under investigation in deductive research is highly structured which most usually could be separated and reduced to relatively simple variables with uni-dimensional structure. It begins with deducing and formulating hypothesis from prior literature in terms of abstracted conceptualisation of “casual and analytic” relationship between one or more variables with other variables. Then it moves on to empirically test and verify those hypotheses so as to create new experiences or observations. Hypotheses are either accepted or rejected using standardized measurement and sampling procedures, thereby facilitating statistical generalization to develop explanation and prediction. The deductive paradigm to management research usually applies to problems that highly structured and most usually generates and uses *quantitative* data.

To the researcher working within the deductive paradigm in the social science, the source of one’s hypotheses is of little significance (Popper, 1967, p. 130). Instead what is important is the logic of deduction and the operationalization process and how this involves the consequent testing of hypotheses by their confrontation with the empirical world. Often such approach is called the “hypothetico-deductive paradigm”. Generally, the hypothetico-deductive paradigm to research is intimately bound up with what is often termed “positivism”. Three of the main characteristics of positivism are:

1. The view that, for the social sciences to advance, they must follow the hypothetico-deductive methodology used, with such evident success, by natural scientists – in a nutshell, the experimental method;
2. The knowledge produced and the explanations used in social science should be the same as those proffered by natural sciences – e.g. that *A causes B*; and
3. The above entails social scientists treating their subject matter, the social world, as if it were the same as the natural world of the natural scientist.

The **left half** of the model represents what is meant by the *inductive construction of theory from observation – theory building*. The logical ordering of induction is the reverse of deduction as it involves moving from the ‘plane’ of observation of the empirical world to the construction of explanation and theories about “what” has been observed, “how” and “why”. For many researchers working within the inductive paradigm, explanations of social phenomena are relatively worthless unless they are grounded in empirical observations. Perhaps the most famous rendition of this paradigm is provided by Glaser and Strauss

(1967) in their book "The Discovery of Grounded Theory". Many researchers of induction paradigm in the social sciences criticize some of the philosophical assumptions embraced by positivism. These critiques are best illustrated by Laing (1967, p.53-64), who points out the error of blindly following the paradigm of the natural science in the study of the social world: 'The error fundamentally is the failure to realise that there is an ontological discontinuity between human beings and it-beings... Persons are distinguished from things in that persons experience the world, whereas things behave in the world.'

Based on Laing (1967)'s arguments, the following issues in the social research should be borne in mind for conducting this research project:

1. Human action has an internal logic of its own which must be understood in order to make action intelligible. It is the aim of social science to understand this internal logic.
2. The subject matter of the natural science does not have this subjective comprehension of its own behaviour – it does not have an internal logic, which the scientist must tap in order to understand its behaviour. Therefore the natural scientist can legitimately, and indeed has to, impose an external logic upon the behaviour of his or her subject matter in order to explain it. But such methodology is inappropriate and does not explain the actions of human beings, due to their subjectivity.
3. Therefore, the social world cannot be understood in terms of causal relationships that do not take account of the situation that human actions are based upon the actor's interpretation of events. His or her social meanings, intentions, motives, attitudes and beliefs; (i.e. human action) are explainable only by understanding this subjective quality. Therefore human action is seen as purposive and becomes intelligible only when we gain access to that subjective dimension.
4. It follows that research in the social sciences must entail emic analyses, in which explanations of human action derive from the meanings and interpretations of those conscious actors who are being studied. Thus the etic analyses embraced by deduction, in which an external frame of reference is imposed upon the behaviour of phenomena, are inappropriate where the phenomena in question have subjective capabilities. It is this subjective interpretation that is the key to explanation in the social sciences.

Inductivists therefore reject the *stimulus-response* model of human behaviour that is built into the methodological arguments of deductive positivism and in favour of:

- (a) Stimulus → experience and interpretation → response, or
- (b) Interpretation and meaning → action.

In (a) above, the actor's subjectivity is taken to be an 'intervening variable' that mediates between the stimuli coming from external social reality and subsequent human responses expressed as behaviour or action. From this perspective, such as *case studies* and *field studies* in social interpretive research incorporate the context of the phenomenon as the

indispensable dimension of studies. The focus is on actors' interpretations and perceptions on meanings of the phenomenon in order to understand the internal logic of actor's subjectivity under the given context. In (b), however, the actor's subjectivity is accorded greater 'formative or creative' power in its own right. Thus the interpretation of reality, upon which actions are based, is not merely the medium through which external stimuli act. Rather, it has a projective quality in the sense that such subjective processes create the reality in which action arises (see Berger and Luckmann, 1967). From this perspective (such as *ethnographic* studies in grounded theory) the research focus is on studying actor's actions and behaviours and the manner people interact and collaborate in observable and natural ways through participate and direct observations in order to capture the internal logic of subjectivity. It is fundamentally that of anthropology and based on what are termed naturalist modes of inquiry. Although these differences have resulted in somewhat different methodological traditions, both (a) and (b) above share a commitment in conceiving human action as arising out of actors' subjectivity and based on actors' interpretation of reality.

These considerations create the need for the study to explain human behaviour adequately, to develop a sympathetic understanding of the 'frames of reference' and 'meaning' out of which that behaviour arises. The methodological implications of this perspective entail the avoidance of the highly structural approaches of deduction; these, it is usually argued, prevent and ignore the penetration of actors' subjectivity. This happens because the deductive researcher, prior to conducting empirical research, formulates a theoretical model of behaviour of interest, which is then tested. Hence they impose an external logic upon a phenomenon, which has an internal logic of its own. It is precisely the discovery of this internal logic, through empirical research on actors' interpretations and perceptions on meanings of the phenomenon that concern many researchers in social sciences. As Burrell and Morgan (1979, p.5-6) suggest, the emphasis here is on building theory from empirical observations, which take account of subjects' meaning and interpretational system in order to explain by understanding.

However in inductive theory building, as Strauss and Corbin (1990, p.51) note, that prior concepts or constructs from the literature provide the foundation for research, especially if one's objective is to elaborate and enrich a body of already existing literature as in this study. Without a conscious attempt at theory building, empirical research merely becomes 'data-dredging', or the ad hoc collection and analysis of data for whatever conclusion can be resulted. Glasser and Strauss (1967) note that knowledge of prior theories from the literature offers the researcher several important and highly compelling benefits in conducting inductive theory-building research from empirical observations:

1. Before the beginning of a project, a researcher can turn to the existing literature to aid identifying research problem that act as a stepping-off point

during initial or pre-research investigations. It helps direct research by identifying those parts of existing literature (as comprised by prior theories) that are either unclear, incomplete or the subject of a paradox. As a result, research becomes less a matter of 'hit or miss' and more a targeted, focused, and purposeful effort of theory building.

2. Prior theories provide a framework for organizing and analysing data. Data, when captured from the field (as is done with empirical research), has no structure. To make sense of this data, we must convert it into information. To do so, we must marry structure to data. Without theory, it is impossible to make meaningful sense of empirically generated data, and it is not possible to distinguish positive from negative results. Broadly defined research questions and constructs are important in building theory from empirical observations (Kerlinger, 1986, p.23). A prior specification of constructs can also help to shape the initial design of theory-building research. If these constructs prove important as the study progresses, then researchers have a firmer empirical grounding for the emergent theory.
3. An essential feature of inductive theory building is comparison of the emergent concepts, constructs, propositions, variables, and hypotheses with the extant literature. The conflicts between the extant literature and the emergent theory often represents opportunity to create deeper insight into both the emergent theory and the conflict literature, as well as sharpening of the limits to generalizability of the focal research.

In short, whatever the question we ask and whatever data we collect reflects the impact of either a theory or framework (explicit or implicit). Whenever we analyse data, we are evaluating the findings in light of these underlying theories or frameworks. As Wright (1995, p.157) puts it, there is merit in open-mindedness and willingness to enter inductive theory-building research looking for questions as well as answers, but it is "impossible" to embark upon research without some idea of what one is looking for and foolish not to make that quest explicit. In other words, as argued by Turner (1988) researchers cannot avoid starting with some framework or perspective in inductive theory-building research, and it is better to make it explicit at the start. In fact, from methodological point of view it is important to have knowledge on the theoretical foundations of the problem under investigation so that one can effectively choose a research design and research methods by which objectives of answering research questions can be fulfilled (Flynn et al., 1990). Discussions on articulating theoretical foundations for manufacturing strategy will be presented in chapter 3.

However it is equally important to recognize the different usage of literature from that of hypothetico-deductive research. Pettigrew et al (1988) argued that researchers of inductive theory-building research should identify a research problem, formulate broad research questions, and possibly specify some potentially important constructs, with some reference to the existing literature. However, they should avoid thinking about and propose specific relationships between constructs as much as possible, especially at the outset of the research.

2. 5. Research Strategies for Empirical Study

As Yin (1994, p.15) notes that there are five *major* strategies in social and organizational sciences for conducting empirical research – *experiments, surveys, histories, archival analysis, and case study*.

A common misconception, as pointed out by Yin (1994), is that the various research strategies should be arrayed hierarchically according to the process of theory development just discussed in earlier section. Platt (1992) argued that case studies were appropriate for the exploratory phase of an investigation. Surveys and histories were appropriate for descriptive phase. Experiments were the only way of doing explanatory or causal inquiries. This hierarchical view, however, is incorrect, as pointed out by Yin (1994, p.3). Experiments with an exploratory motive have certainly always existed. In addition, the development of causal explanations has long been serious concern of historians, reflected by the sub-field known as historiography. Finally, case studies are far from being only an exploratory strategy for empirical research. Some of the best and most famous case studies have been both descriptive (i.e. Whyte's *Street Corner Society*, 1943/1955) and explanatory (see Allison's *Essence of Decision: Explaining the Cuban Missile Crisis*, 1971).

The more appropriate view of these different strategies for empirical research is a pluralistic one. Each strategy can be used for all three purposes – exploratory, descriptive, or explanatory. There may be exploratory case studies, descriptive case studies, or explanatory case studies (Yin, 1981). There are also may be exploratory experiments, descriptive experiments, or explanatory experiments. What distinguishes the strategies, as suggests by Yin, is not this hierarchy but three other conditions. These three conditions are:

1. **The type of research questions posed,**
2. **The extent of control an investigator has over actual behavioural events,**
3. **The degree of focus on contemporary as opposed to historical events.**

Yin (1994, p.4)

The first and most important condition for choosing and differentiating among the various research strategies is to identify the *type* of research questions being asked (Yin, 1994, p.7). Four essential types of research questions have been discussed in the earlier section on building blocks of theory.

If research questions focus mainly on “*what*” questions, such as ‘what are the key issues and important aspects of the phenomenon?’ and ‘what are major constructs and categories in characterizing the phenomenon?’, the research is justifiable for conducting an *exploratory*

study as we discussed in earlier section (Philips and Pugh, 1987; Webb, 1992; Ghauri et al; 1995; Yin, 1994). However, as an exploratory study, any five research strategies can be used – for example an exploratory survey, an exploratory experiment, or an exploratory case study.

If research questions focus on “*who*”, “*where*”, “*when*”, “*how many*”, or “*how much*” questions, the research is likely to favour *survey* strategy or *archival analysis* strategy. These two strategies are advantageous when research goal is to describe the incidence or prevalence of a phenomenon or when it is to be predictive about certain outcomes.

In contrast, “*how*” questions are a little more explanatory in characterizing how key constructs and variables of the phenomenon are related to each other. And “*why*” questions are explanatory in nature focusing on building and explaining the causal and analytic relationships between variables and giving logical and analytical structures to the phenomenon under investigation. Questions on “*how*” and/or “*why*” are likely lead to the uses of case studies, histories, and experiments as the preferred strategies (Yin, 1994, p.6).

In addition, as Campbell (1986) suggest that the *nature* and *substance* of the research questions will determine the primary type of evidence needed for the studies. As Wright (1995) suggests, if the substance of questions is on matters pertaining to structures and contents of the phenomenon, and linear relationship, number counting, statistical analysis are the central issues of the phenomenon, then quantitative evidences will be the primary data source. In contrast, if the focus of studies is on matters pertaining to the organizational processes and linking mechanisms involved in the phenomenon, and the interactive, holistic, interdependent context-specific characteristics are the central issues of the phenomenon, qualitative evidences will be the primary data source (also see Campbell, 1986).

Defining the research questions is probably the most important step to be taken in an empirical research study. To determine the research questions that are most significant and important for the phenomenon under investigation, researchers should consider multiple sources (Yin, 1994; Strauss and Corbin, 1998). Sources of research questions in this study will be reviewed in the next chapter.

2. 6. Conclusion

In summary, philosophical basis of the research rests in the essential thesis of social and organizational science for conceiving human action as arising out of actors' subjectivity and based on actors' perspective and interpretation of reality. Human action is seen as purposive and becomes intelligible only when researchers gain access to that subjectivity. The social world, therefore, cannot be understood in terms of causal relationships that do not take account of the situation that human actions are based upon the actor's perception and interpretation of events. The research, then, follows the philosophical model of:

Stimulus → perception and interpretation → response

For methodological implications, two essentially different *theory development paradigms* in social and organizational science, namely "common-sense inductive model" and "hypothetico-deductive model", have been reviewed and discussed in details. Both the 'inductivist' and the 'deductivist' paradigms correspond to styles of doing empirical research; both have philosophical flaws, which enable them to be criticized forever. However, in this study the inductive and deductive aspects of theory development are regarded as "inextricably intertwined," not only at the level of specific *data set* but also at the levels of study *design* and *analysis*. Among the five major research strategies reviewed in social and organizational sciences, it is case study method that further stressed out this epistemological concern more specifically. Within case studies there are always both inductive and deductive aspects that call for the integrative perspective from researchers to effectively configure them together. Of special note is the *critical* and *influential* role of prior concepts and constructs from the literature played in both deductive and inductive theory development research, although given the different usage of the literature respectively.

In addition, the author has also reviewed the multidimensional nature of management as research subject, the fundamental goal of management research, and building blocks of management theory.

3. Research Groundwork & Literature Review

3. 1. Introduction

This chapter has picked up from the philosophical basis of the research presented in chapter 2, and begun with defining research questions for this study. It has been demonstrated how research questions are defined using the triangulation of three major sources - the contemporary literature, "pre-research" field investigations, and specialists' suggestions in the academic institution. The type of research questions and their substances and characteristics have directed this study towards empirical investigations incorporating case study research method.

It has been reviewed in chapter 2 that the three pillars on which theory is developed are observation, induction, and deduction. Inductive and deductive aspects of theory development are "inextricably intertwined," not only at the level of specific data set but also at the levels of study design and analysis. It is important to note, within case studies, as suggested by Yin (1994) and many others, there are always both inductive and deductive aspects that call for the integrative perspective from researchers to effectively configure them together. Of special note is the critical and influential role of prior concepts and constructs from the literature played in case study research. With this in mind, the chapter has then critically reviewed the manufacturing strategy literature. In the literature, there has been considerable research and underlying concepts established regarding the development of manufacturing strategy. These underlying concepts were used to develop theoretical framework and analytical templates applied during data collection and analysis. Limitations in the existing paradigm of manufacturing strategy development have been further examined. The serious "unitary" and "contextual" bias in existing paradigm has been addressed explicitly through an analytical review conducted by the author on previous empirical studies in the literature. The weakness in the research methods and focus of published studies have been revealed and analysed. Adam and Swamidass (1989) and Minor et al (1994) pointed out that the theory development of manufacturing strategy seems to be endlessly stalled for want of high quality empirical research. They regarded this as the main reason for the limitations in the existing paradigm developed to date.

3. 2. Sources of Research Questions

Research question, defined by Strauss and Corbin (1998, p.35), is the specific query to be addressed by the research in studying the phenomenon under investigation. It sets the parameters and research strategy of the project and suggests the methods to be used for data gathering and analysis.

As Strauss and Corbin (1998), Yin (1994), and Silverman (1993) suggest, there are three major sources of research questions:

First, there are suggested or assigned research questions. One way in which to arrive at a question is to ask for suggestions from specialists in academic or research institutions who are doing research in the area of study.

A second source of research questions is the technical and non-technical literature. This can be a stimulus to research in several ways. Sometimes, it points to relatively unexplored area or suggests a topic in need of further development. Other times, there are contradictions or ambiguities among the accumulated studies and writings. The discrepancies suggest the need for a study that will help to resolve those uncertainties. Alternatively, a researcher's reading on a subject might suggest that a new approach is needed to solve an old problem, even though it has been well studied in the past.

A third source of research questions is pre-research investigation. A researcher might enter the field having a general notion about what he or she might want to study but no specific problem area. A good way in which to begin is to do a pre-research investigation. If the researcher is carefully interviewing and listening to respondents, then analysis should lead him or her to discover the key issues that are important or problematic in the actual context of respondents' lives. This acid test of paying attention to respondents' concerns and perceptions is the key to where the focus of a research project should be.

In this project, research questions were defined through using the triangulation of all three types of sources.

3. 3. Defining Research Questions

This section will define research questions for the project using triangulation of three major types of sources identified in the previous section.

3. 3. 1. Defining Research Questions from the Contemporary Literature

In the literature of manufacturing strategy, there is a dedicated section on the strategic management of Next Generation Manufacturing and its major challenges. One of the most significant contributions in this section is the Agility Forum, with sponsorship from the National Science Foundation, published *Next-Generation Manufacturing: A Framework for Action* (Hughes, 1997). The four-volume publication documented the results of the Next-Generation Manufacturing (NGM) Project, which involved individuals from more than 100 companies, industry associations, academic institutions, and government agencies.

As the project leaders noted in their summaries, the contemporary competitive environment of manufacturing organizations is characterized by its dynamics, by the fact that resources tightly managed, by more demanding and discriminating customers. In sum, as they pointed out, the pressure for businesses to do more with less is intensifying further. In addition, advancements in technology, especially information and communication technology (ICT), allow critical business and technological information to be available around the world at ever faster speed and cheaper cost. The ICT explosion has generated new trends in the marketplace such as intensity of market competition, rapidly evolving product and process technology, unbridled globalisation of markets, technology, and business competition, shortening product life cycles, and the urgency to deliver ever increasing customerization and customer value. Taking in aggregate, the explosion of information, communication, transactions, and production technology is changing the way firms communicate with and learn from customers, competitors, and supply partners. It has allowed manufacturing companies to coordinate logistics and information with more dispersed and global networks of suppliers and customers to manage more geographically dispersed operations with more culturally diverse workforce. However, over time, technology, customisation and globalisation trends working in concert have resulted in order-of-magnitude increases in the uncertainty and complexity of the strategic manufacturing management. Particularly, Mabert and Venkatraman (1998) suggest that emerging production issues dealing with the

globalisation of production, global supply chain management, management of AMT, integrated product/process development, mass customisation and a growing e-business environment are challenging issues that are expected to critically influence the strategic success of a firm's business operations. Given the foregoing, they pointed out that developing new means for integrating decision-making activities, with strategic consensus both within and beyond organizational boundaries of the production system, has become the major challenge for the strategic management of manufacturing.

In the face of these major challenges, the existing paradigm of manufacturing strategy development appears to be inadequate when operationalizing the underlying concept of strategic manufacturing management in the contemporary context of business operations. More and more manufacturing companies, as reported by the NGM project, are finding that analytic methods and decision aids from the existing paradigm are incapable of adequately responding to the demands of this increasing contextual variation and complexity (Hughes, 1997). Critical concerns and limitations in the existing paradigm of manufacturing strategy development have been addressed explicitly in a recent special issue of the *Journal of Operations Management*¹. Within this special issue the paper of St. John et al., "Change Drivers for the New Millennium: Implications for Manufacturing Strategy Research", called for the need to develop a multidimensional and situational profile of the subject in relation to the contemporary context of business operations. As St. John et al pointed out, future empirical research should follow a contingency approach and focus on exploring and conceptualising the empirical paradigm of manufacturing strategy development in a wider social, cultural, and political setting. They also suggest the configuration approach as the promising avenue for such development. In general, as Miller and Mintzberg (1988) noted, the configuration approach to the study of strategy involves identifying dominant gestalts of observable characteristics or behaviours, which appear to lead to a particular performance outcome and an organizational pattern in the lifecycle.

The traditional linear approach in relating strategy development to its context would be to take one or two elements of strategic management practice (content or process) at a time and relate them to individual organizational or environmental context variables. Given the dramatic increase in the uncertainty and complexity for the strategic management of manufacturing, an emerging problem with this approach is that research would be in a position of having to formulate a myriad of bivariate or

¹ *Journal of Operations Management*, Volume 19, Issue 2, Page 129-256 (February 2001)

circumscribed multivariate hypotheses. These would be extremely arduous to construct and, perhaps, conceptually intractable. An even more serious shortcoming of this approach, as Miller (1983 and 1986) suggests, is that social reality usually cannot be expressed in terms of linear bivariate or even multivariate relationships (See chapter 2 for details). Statistical and real associations among variables, as he noted, are largely a function of the "context" in which they occur. Relationships cannot, then, be divorced from their "context". So the traditional 'few variables at a time' alternative of relating strategy development to its embedded context would seem to be not only rather cumbersome, but downright misleading as well. Configurations, defined by Miller and Friesen (1984) as "commonly occurring clusters of attributes or relationships...that are internally cohesive", while Meyer et al. (1993) describe them as "any multidimensional constellation of conceptually distinct characteristics that commonly occur together". Methods for conducting configuration research in relating managerial phenomena to their embedded context are already well established in other disciplines of social and organizational science. Since Miller's (1986) landmark article "Configurations of strategy and structure: towards a synthesis", configuration models have generated a great deal of interest in the business strategy and manufacturing strategy area, as witnessed by a special issue in the *Academy of Management Journal* (Meyer et al., 1993) and a recent special issue in the *Journal of Operations Management*².

In general, as Miller and Mintzberg (1983) noted, the configuration approach yields a systematic, multidimensional, and holistic image of the social reality, without attributing causation to any of the individual parts of the whole. The distinguishing characteristic of configuration models is the establishment of multidimensional and integrative profiles, which are well suited to the study of complex, multivariate organizational phenomena in describing strategy process, strategy content and overall operating context of the organization. The prime thesis of the configuration research in relating strategy development to its context, as Miller (1986, p.235) suggests, is that strategy development practice and its embedded context often coalesce or configure into a manageable number of common, predictively useful types that characterise a large proportion of high-performing organizations. The configurations (or 'gestalts', or 'archetypes', or 'generic types') are said to be predictively useful in that they are composed of tight constellations of mutually supportive elements. Thus, each element makes sense in terms of the whole - and together they form a cohesive system (Miller and Friesen, 1984, p.22). The presence of certain elements can thus lead to the reliable predictions of the remaining

² *Journal of operations Management*, Volume 18, Issue 6, Page 601-737 (November 2000)

elements (Miller and Mintzberg, 1983). Configuration models are typically divided into taxonomies and typologies (Miller and Friesen, 1984; Meyer et al., 1993). While both offer multidimensional delineations and categorizations of organizations, they differ markedly with regard to their underlying purpose, key characteristics, and the theoretical statements embodied within them. Typologies describe ideal types, each of which represents a unique combination of organizational attributes (Doty and Glick, 1994). In other word, a typology tries to describe what is the most important aspect of the phenomena or activity under consideration. Taxonomies attempt to classify organizations into mutually exclusive and exhaustive groups (Doty and Glick, 1994; McKelvey, 1982). In other word, taxonomies deal with a categorical analysis of the data.

The pedagogical and theoretical power of configuration models are evidenced by the typology of strategic types of Miles and Snow (1978), the generic strategies of Porter (1980), Mintzberg's typology of organizational structure (1984) and in manufacturing strategy literature by the taxonomies of Four Stages effectiveness model of Wheelwright and Hayes (1985), the three strategy groups of Miller and Roth (1994) and the typology of five generic manufacturing types of Hill (1994).

Bozarth and McDermott (1998) examined the current state of configuration research in the manufacturing strategy area. Their review observed that, although significant progress has been made, the manufacturing strategy area as a whole has been held back compared with developments in the business strategy literature and other fields within organization sciences. This is largely due to the under-utilization of configuration research methods and the resulting lack of empirical developed and tested taxonomies and typologies of manufacturing strategy, especially in an international context. Among a total of eight configuration models developed over time, seven out of the eight models describe strategy types and contents while only one exception of Wheelwright and Hayes (1985)'s taxonomies of Four Stages Effectiveness Model is related to the development process of manufacturing strategy.

3.3.2. Defining Research Questions from Pre-research Field Investigations

For this doctoral research project, a pre-research investigation for defining research questions has been carried out at the site of Beijing Yanshan Petrochemical Group Co., Ltd (hereafter referred to as Yanshan), from which five of its strategic business divisions (SBUs) in the core petrochemical manufacturing business have been chosen as main case study companies in the research. The detailed introduction of Yanshan and explanation on choosing of case companies will be presented later in chapter 5 - Research Design and Methodology (see section 5.2.4). Within the pre-research investigation, 6 focused interviews were conducted with key of senior management personnel including the CEO of Yanshan. Table 3.1 and table 3.2 illustrated those respondents interviewed and questions investigated.

Table 3.1 Respondents of Focused Interview

Respondent A	Mr. DU Guosheng	The CEO of Yanshan – interview 1
Respondent B	Mr. YANG Qingyu	Vice President of Yanshan – interview 2
Respondent C	Mr. WANG Reihua	Vice President of Yanshan – interview 3
Respondent D	Mr. LIU Yueli	Marketing Executive of Yanshan – interview 4
Respondent E	Mr. WANG Liqun	Human Resource Executive of Yanshan - interview 5
Respondent F	Mr. LIU Wanlu	General Manager of Polypropylene Division of Yanshan – interview 6

Table 3.2 Questions of Focused Interview

Focused Interview Question 1:

- Does the management of Yanshan involve with developing and managing Manufacturing Strategy? If so, since when and at which level or levels does the management of Manufacturing Strategy occur?

Focused Interview Question 2:

- At which level does the management of Manufacturing Strategy primarily occur at Yanshan?

Focused Interview Question 3:

- What are the key issues in the management of Manufacturing Strategy?

Findings from focused Interviews

- **Responses to question 1:**

There has been a clear consensus and agreement among respondents regarding question 1. Yanshan, as they noted, started to engage with the management of manufacturing strategy development only after the Modern Enterprise Systems (MES) reform, or more specifically, since the share holding system restructuring in 1997. Before that the strategic planning of manufacturing was mainly managed at the corporate centre and with very limited independence and autonomy from State interference. Detailed discussion on organization change and management reform will be presented later in chapter 6 (see section 6.3 for details).

Through the share holding system restructuring, Yanshan has gradually corporatized its strategic business divisions in both core petrochemical manufacturing business and diversified petrochemical manufacturing business. Until the time of interviews, 16 of its business divisions have been corporatized and restructured into controlled business subsidiaries of the group. Those five business divisions in the core petrochemical business of Yanshan have been further reorganized into Yanhua Petrochemical Co., Ltd. and were successfully listed on stock exchanges in Hongkong, New York and Europe in early 1998.

However, as Mr. DU, the CEO of Yanshan, pointed out that structure-oriented change in the organization was just the start and maybe, only just set out the context for the real change needed in China's SOEs. The enforced 'clear-cut' political measures emanating from the state, such as restructuring has been relatively easy. What is difficult, as he pointed out, was to change the management's perspective and managerial paradigm accordingly to match the new business environment and corporate structure now in place. Without the reconfiguration of the managerial perspective, the structural changes would have little impact to the improvement of SOEs' performance. And eventually, as he suggested, the real change needed in China's SOEs is changes in the mindset of people, both managers and workers alike (Interview 1, 1999). In response to the second half of the question 1, all respondents have acknowledged that production system has been contributing as one of the pillars of the firm's achieved long-term competitiveness in the marketplace and manufacturing strategy is currently managed at all three levels (corporate, business, and functional) of the firm.

- **Responses to question 2:**

For this question, the answer is very much straightforward. All respondents acknowledged that the development of manufacturing strategy is primarily occurred at Strategic Business Unit level (SBU level).

- **Responses to question 3:**

There has been a widely shared acknowledgement about the underlying concepts regarding strategic manufacturing management established in the Western literature. However, the most problematic, in the view of many respondents, is the managerial perceptions and perspectives advocates in the West when operationalising these concepts, particularly those methodologies from the existing paradigm. The consensus among respondents appears to be that Westernised managerial paradigm and its methodologies often display a rather naive and unitary perspective of the nature of strategic management decision-making, one which largely overlooks the context-embedded emergent factors and the social/political influences on the development of manufacturing strategy.

A very informative finding is the specific insights from Mr LIU Wanlu – general manager of Propylene Business Division of Yanshan (Interview 6, 1999). At the frontline of strategic management of manufacturing, as he pointed out, there are not such distinguishable stages between formulation and implementation as advocated by managerial consultant from the West. All the time he has to work together with all other functional executives in his division to manage competitive and functional strategy process including manufacturing strategy. It is not like he formulates a strategy and leaves it to others to implement. Rather, as he pointed out, they think together, make those strategic decisions together, transfer those decisions into action together, and keep watching and modifying the strategy together. As he regarded that “how” the process of strategic thinking, strategic decision-making, and strategic change should be managed is the essential issue in the management of manufacturing strategy.

Except the question of “how”, there is also another key issue regarded by many respondents at Yanshan. It is the question of “why”. Since the share holding systems restructuring in Yanshan, management has been persuaded by consultant to apply those widely used Westernised models and tools to the management of

manufacturing strategy. But there has been very little impact on the performance of business. This has given rise to the key issue regarding manufacturing strategy development – “why” those Westernised models and tools could not generate much impact in the business setting of SOEs in China’s petrochemical industry.

Summarized thus far, the pre-research investigation at Yanshan has effectively revealed that:

- Management of manufacturing strategy is a contemporary managerial phenomenon that emerged together with the corporatization reform and share holding systems restructuring of China’s SOEs. In fact, as discovered at Yanshan, it is also a continuous event as to the ongoing transformation and configuration of management systems and processes in the organization.
- Management of manufacturing strategy is primarily occurred at SBU level.
- The key issues in the management of manufacturing strategy are not addressed to the underlying concepts of manufacturing strategy established over time in the literature but rather focused on the existing managerial paradigm and its methodologies advocated in the West when operationalising these concepts in the local operating context. The primary key issue regarded by the management is: “how should the manufacturing strategy development practice be managed and improved?” or more specific, “how should the practice of strategic thinking, decision-making and strategic change be managed?”
- The secondary key issue regarded by the management is: “why could not those Westernised models and tools of manufacturing strategy development from the existing paradigm generate much impact in the business setting of SOEs in China’s petrochemical industry?” It indicates that specific contextual conditions of china’s SOEs both in term of organizational and environmental context might be highly pertinent to the phenomenon of manufacturing strategy management. Also it indicates that the boundaries between the phenomenon and its context are not currently evident in the case of China’s SOEs.

3. 3. 3. Defining Research Questions from Specialists' Suggestions in the Academic Institution

In order to confirm findings of investigation at Yanshan, a one-day field study was carried out at Beijing Institute of Economic Management (BIEM). BIEM was founded in 1979 and approved by Beijing Municipal Government and accredited by China State Education Commission. It is one of the leading academic institutions in research on State Enterprises reform and management in China. In fact, it has been authorized by the State Economic and Trade Commission as one of the top training centres for executives and functional managers from 512 major SOEs in China, it has the record of over 8,000 managers from SOEs trained each year.

The field study at BIEM was taking the form of a group discussion between the author and two professors from BIEM. They are, Professor Fang Fulou, senior economist and vice president of BIEM; and Professor Wei Jing, deputy director of BIEM.

Both Professors acknowledged that Yanshan is a typical and representative sample of SOEs in China's petrochemical industry both in term of organizational and environmental context of business operations. Perhaps more so, as noted by Professor Fang, because Yanshan has kept well its own continuity ever since it was founded at early 1960s. And in fact, many government officials, both at Beijing Municipal level and Central Government level, are from Yanshan. Therefore, as they noted, Yanshan is a very precious sample in studying the reform and management of China's SOEs and the research finding could have significant implications in providing guides and insights for both the firm and the government.

They also point out that management reform in SOEs is far from finish, and in fact, it has just set up the context needed for the real move. On this point, their suggestions not only confirmed investigation findings at Yanshan, but also are in line with the argument of Forrester and Porter (1999). As Forrester and Porter (1999) noted that these various reform models and political measures emerged as part of the process of formulating the policy itself. As one system falls from grace, new reform models are introduced, praised and widely publicized as a change for the better. Latter, however, a host of complex and intractable problems are reported. As they pointed out that the role of the Communist Party of China, and the extent to which it is willing to relinquish even part of its power over industrial activity, is of paramount importance

here. This would need a profound change in China's political culture, which, it would appear, is unlikely in the near term.

For the key issues in strategic manufacturing management, two professors both agreed with the managerial perceptions at Yanshan that the key issues are mainly to do with the 'managerial paradigm' when operationalising the concept of manufacturing strategy during practice. But they stressed out that in order to answer the question of "how" and "why", the research has to base on empirical understanding and insight on "what". What are the 'empirical paradigms' of manufacturing strategy development applied therein high-performing SOEs within China's petrochemical industry? What are the empirical specifics and managerial perspectives regarding the context of consideration for developing manufacturing strategy? What are the empirical specifics and managerial perspectives regarding the 'content' and 'process' of manufacturing strategy? What are the linkages between different patterns of the process organization and overall paradigm of manufacturing strategy development? What are the implications of manufacturing strategy development on corporate management, management reform, and organizational change of SOEs at the firm level?

As they noted that answers to these questions of "what" would explore, delineate, and conceptualise the essential constructs, relationships, patterns, and organizations of manufacturing strategy development in China's SOEs. This will provide an analytical framework for interpreting and conceptualising the management paradigm of manufacturing strategy development in China's SOEs and its comprising key issues. As noted in the previous chapter, usually it is hard to explain something satisfactorily until you understand just what the something is. Description, particularly in analytical sense, is an important knowledge-generating concept and source material of theories. Thus, a natural theoretical progression, as Rein and Schon (1977) suggest, is from "what" and "how" to "why".

Two Professors also acknowledged that to their awareness on the literature, particularly Chinese literature, there has no published research done on "the subject" - empirical paradigm of manufacturing strategy development in large-scale SOEs. Currently, as they noted, local research on 'strategic management of business operations in large-scale SOEs' is mainly focused on investigating effects and implications of corporate reform programmes and industrial policy-making. Although, as they suggested, there has been an emerging trend of empirical studies towards firm-level strategy development for business operations, published research so far has mainly concentrated on strategy development for marketing and technology

transfer. Perhaps, as two professors suggested, it is one of the main reasons “why” those westernised methodologies from the existing paradigm of manufacturing strategy development have not been tailored to suit SOEs’ situation in China. As to the current state of play regarding management reform in China’s petrochemical industry, they also provided the author with an essential reading list of contemporary academic writings that represent the central outlets for local strategic operations management research. This is to be presented in the appendix of the thesis. Exploratory nature of “the subject” will be further justified in the later section through a critical review of the literature of manufacturing strategy in the West. Finally, based on the above constructive and thorough discussion on the common research interests, BIEM issued an official Memo to express its willingness in developing and establishing cooperation between Aston Business School and BIEM for doing such exploratory research on “the subject” (See attached document in Appendixes).

3. 4. Choosing A Research Strategy

The three conditions for choosing and differentiating among the various research strategies have already been discussed in section 7 of chapter 2. The focus was on the first and most important condition that is to identify the type of research questions. Here in this section, the focus will be on two other conditions and the final choice of research strategy for this project.

These two other conditions are:

- The extent of control an investigator has over actual behavioural events.
- The degree of focus on contemporary as opposed to historical events.

As the previous section revealed that management of manufacturing strategy is a contemporary managerial phenomenon in China's SOEs and the process of manufacturing strategy is ongoing event for management of the organization.

For the relevant situations of differentiating among research strategies on all three conditions, Yin (1994, p.6) provides a graphical framework as an analytical template (see Table 3.3).

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	What, How, Why	Yes	Yes
Survey	Who, What, Where, How many	No	Yes
Archival analysis	Who, What, Where, How many	No	Yes/No
History	What, How, and Why	No	No
Case Study	What, How, and Why	No	Yes

[Adopted from Yin (1994)]

Table 3.3 Relevant Situations for Differentiating Research Strategies

As table shows that the various research strategies are not mutually exclusive. But we can also identify some situations in which a specific strategy has a distinct advantage. For the context of the research and as to the case study strategy, this is when:

- “what”, “how” or “why” question is being asked about a contemporary set of events over which the investigator has little or no control.

Yin (1994, p.9)

Therefore, the choice of research strategy for this project is case study strategy, which gives the best advantage and unique strength in exploring the phenomenon through triangulation a full variety of empirical evidence – documents, archival records, focused interviews, semi-structured in-depth interviews, and observations.

The definition of a case study strategy includes two essential elements.

First, the definition begins with the scope of a case study: a case study, as defined by Yin (1981 and 1994), is an empirical inquiry that

- **Investigates a contemporary phenomenon within its real-life context, especially when**
- **Boundaries between phenomenon and context are not clearly evident.**

In other words, you would use the case study method because you deliberately wanted to cover contextual conditions – believing that they might be highly pertinent to your phenomenon of study.

Second, because phenomenon and context are not always distinguishable in real-life situations, a whole set of the technical characteristics, including data collection and data analysis strategies, now become the second part of the definition:

- **Copes with the technically distinctive situation in which there will be many more variables of interests than data points, and as one result**
- **Relies on multiple sources of evidences, with data needing to converge in a triangulating fashion, and as another result**
- **Benefits from the prior development of theoretical frameworks to guide data collection and analysis.**

In other words, the case study as a research strategy comprises an all-encompassing method – with the logic of incorporating specific approaches to data collection and to data analysis. In this sense, the case study is not either a data collection tactic or merely a design feature alone but a comprehensive research strategy (Stoecker, 1991).

3. 5. The Role of Prior Literature in Case Study Research

Several important benefits of knowledge on prior concepts and conceptual frameworks from the literature in conducting empirical theory-building research have been presented in the section 5 of chapter 2. Here in this section, the author will take a close exam on the role of prior literature in theory-building case study research.

The role of prior literature in general and constructing preliminary theoretical design in specific is one point of difference between case studies and related methods such as ethnography (Lincoln and Guba, 1985, 1986; Van Maanen, 1988; Van Maanen et al., 1982). Typically, these related methods deliberately avoid any priori specification of constructs and pre-structured theoretical design at the outset of an inquiry. But for case studies, conducting preliminary theoretical design is essential, whether the ensuring case study's purpose is to develop or to test theory (Yin, 1994, p.27).

Research questions that one posed, capturing what you are really interesting in answering, led research to the case study as the appropriate strategy in the first place. Nevertheless, these research questions do not point to what you should study in order to answer them. As Yin (1994, p.21) suggests that only if researcher is forced to construct theoretical design will research move in the right direction. Theoretical design, as suggested by Yin, defines the major constructs, variables, and propositions of causal relationships that should be examined with the scope of the study in order to answer those questions of the research.

At the same time, as Yin noted, some studies may have a legitimate reason for not having any proposition of causal relationships between constructs and variables. This is the condition in which a topic is the subject of "exploratory research" as in this project. Every exploratory research, however, should still have a framework and template of analysis, which Yin (1994, p. 21) termed a "preliminary theoretical design". Instead of stating propositions, the theoretical design for an exploratory case study should include:

1. What is to be explored – key issues and major constructs should be examined within the scope of the research.
2. A blueprint for empirical investigation – a conceptual framework of analysis, which defines operational items in empirical exploration and facilitates data collection, e.g., essential content elements of manufacturing strategy, critical contextual aspects of consideration

with respect to manufacturing strategy development, essential facets of investigation revealed in the literature of business strategy for delineating strategy process.

3. Template of analysis for analytical generalization – a previously developed characteristics statement used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same characteristics, replication may be claimed.

3. 6. A Critical Review of Manufacturing Strategy Literature

As noted in the previous chapter, from the methodological point of view it is important to have a deep understanding on the theoretical foundations of the phenomenon under investigation so that one can effectively justify the nature of the research (exploratory, descriptive, or explanatory) and facilitate choosing a research design and methods by which objectives of answering research questions can be fulfilled (Flynn et al., 1990). In this section, the theoretical foundations for manufacturing strategy will be articulated, through which the “exploratory” nature of the research will be further justified from the perspective of literature review.

3. 6. 1. Theoretical Foundations for Manufacturing Strategy

The role of the production system as a determinant of competitive performance has long been the subject of organization research, even predating the explicit conceptualisation of manufacturing strategy in the literature. The focus of most early work conducted within the organization sciences was on the impact of the organization’s production task and technology on its structural characteristics (Gerwin, 1981). Woodward (1958), Thompson (1967) and Lawrence and Lorsch (1967), to name only a few, found the important relationship between production technology and the organization’s structure and control systems.

An assumption underlying most early work was that the production system had one main task — to move toward the most efficient, low-cost state by investing in automation and standardization in response to predictably maturing markets. In the late 1960s, Skinner’s (1969) seminal work made persuasive arguments that the production system, rather than always simply seeking internal consistency and efficiencies, should be aligned with overall organizational and environmental context of the firm and reflect the competitive priorities of the business. His arguments for a contingency-based manufacturing strategy spurred a generation of interest in the means of integrating manufacturing within the overall strategic configuration of business operations. Since then there is a growing recognition of the need to position manufacturing appropriately for competitive advantage and an increasing call for the strategic management of manufacturing (Hayes and wheelwright, 1979; Buffa, 1980; Skinner, 1985; Hill, 1989). The consensus appears to be that appropriate positioning of manufacturing can be achieved by the development of a manufacturing strategy (Hayes and Wheelwright, 1984 and 1988).

Manufacturing strategy has been defined by many authors. Usually, definitions include some mention of positioning resources or building capabilities of manufacturing in an integrative way, which enhances a firm's competitive position in marketplace. Although there is not one generally accepted definition of manufacturing strategy, several most influential conceptions have presented and specified what it does, what it addresses, and its characteristics. Here will elaborate on three of these most influential conceptions, which are regarded as the essential underlying concepts of manufacturing strategy.

- **Conception 1: the goal of manufacturing strategy is to use and build the production system as a strong source of business competitiveness (see Skinner, 1978; Hayes and wheelwright, 1984).**

The strategic management of manufacturing started to gain momentum since the publication of Skinner's article "Manufacturing – missing Link in Corporate Strategy" (Skinner, 1969). Skinner argued that the linkage between manufacturing effectiveness and corporate success go far beyond merely ensuring high efficiency and low cost and should be considered within the overall organizational and environmental context of the firm. He advanced these major ideas: (a) the manufacturing function can and should be employed as a competitive weapon, (b) cost and efficiency are inadequate goal for manufacturing, (c) " a factory that focuses on a narrow product mix for a particular market niche will outperform a conventional plant" (Skinner, 1974, p.114).

This concept is best captured in Skinner (1985)'s and Wheelwright and Hayes (1985)'s definitions of manufacturing strategy, which is summarized by Swamidass and Newell (1987, p.509):

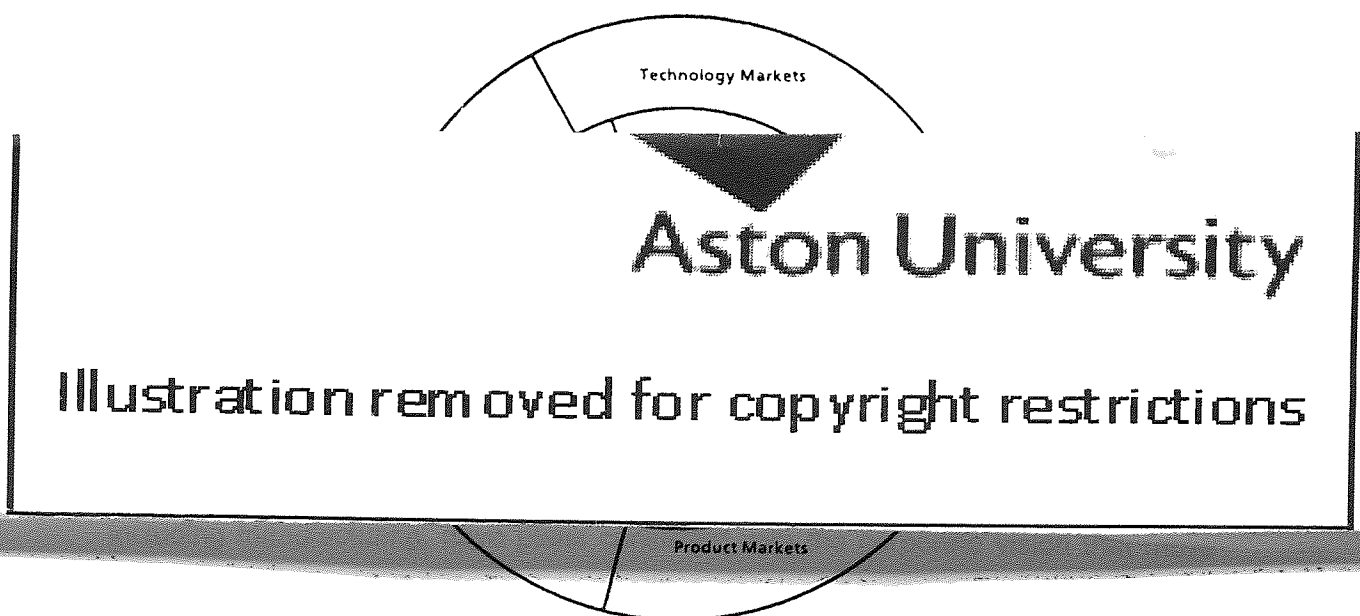
Manufacturing strategy is viewed as the effective use of manufacturing strengths as a competitive weapon for the achievement of business and corporate goals. Manufacturing strategy reflects the goals and strategy of the business, and enables the manufacturing function to contribute to the long-term competitiveness and performance of the business.

In focusing on being competitive in manufacturing operations, there is no suggestion of ignoring operations of other functions and elements of a business strategy.

- **Conception 2: the primary goal of all strategy effort is successful performance of the firm. Cooperation, integration, and consistency of overall objectives are the key to success in the management of strategy. It must be directed generally at the excellence of the firm. It is not directed at the sub-optimisation of manufacturing or any other functional are at the expense of optimisation of the firm (Hayes and wheelwright, 1984).**

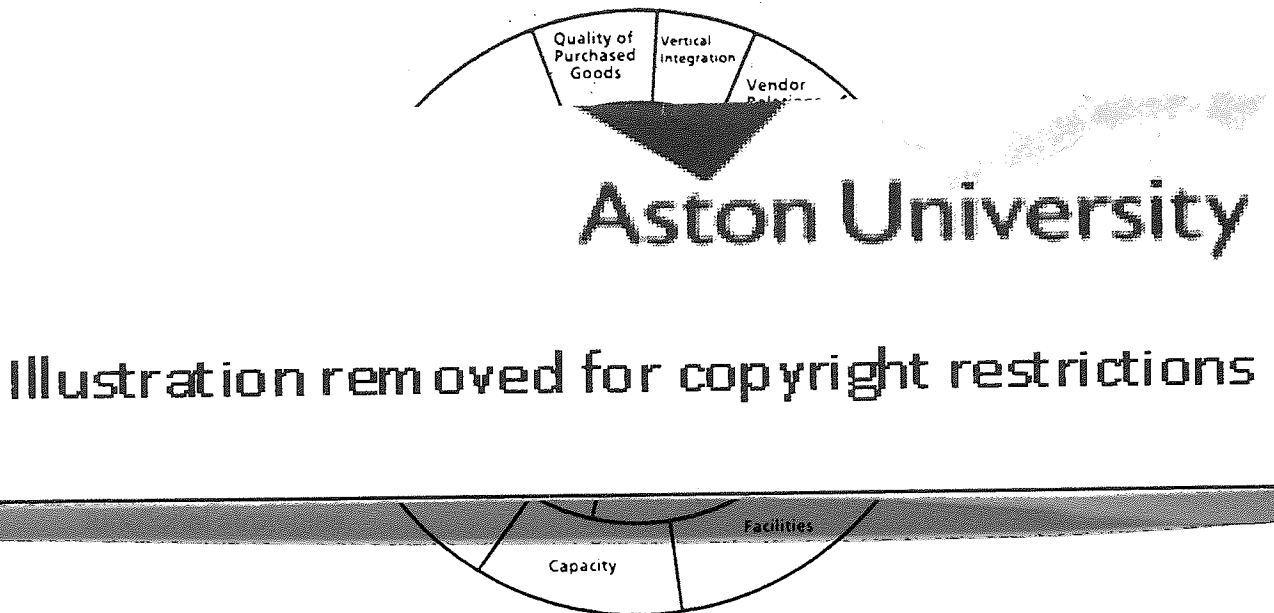
Based on Hayes and Wheelwright (1984)'s conceptualisation of manufacturing strategy, Fine and Hax (1985) suggested that manufacturing strategy could not be formed in a vacuum; it affects and is affected by both organizational and environmental context inside and outside the firm. Because of the interrelationship among the firm's manufacturing unit, its divisions and other functional areas, and its competitors and markets, the process of designing a manufacturing strategy must be carried beyond the borders of the firm's production organization. First, they suggested, in developing manufacturing strategy, production managers must work with finance, marketing, engineering and R&D, personnel, and purchasing. Integration and consistency of decision-making is the key to success in these interactions. Second, the process of developing manufacturing strategy must be based on carefully monitoring of firm's environmental context by production along with the other functional areas. This conceptual development on the integration of manufacturing decision-making in firm's strategic context is demonstrated in their analytical framework (see Figure 3.1 and Figure 3.2).

Figure 3.1



Adopted from Fine and Hax (1985)

Figure 3.2



Adopted from Fine and Hax (1985)

Again, as Hayes and Wheelwright (1984) pointed out, the aim of a manufacturing strategy is not raise the quality of manufacturing management and performance per se, but to raise it, direct it and integrate it so that it increases the effectiveness and competitive advantage of the firm in the marketplace. As Anderson et al., (1991) suggested that it was this complementary nature of manufacturing strategy and other functional strategies, which creates an effective business strategy and superior performance of the firm.

Manufacturing strategy is part of the widely accepted hierarchy of strategy suggested by Hofer (1975), Hayes and Schmenner (1978).

- **Conception 3: corporate, business, and functional hierarchy, each level has a distinct and important role to play in achieving competitive advantage, and the firm's manufacturing strategy is designed at all three levels (see Schroeder et al., 1986; Hayes and Wheelwright, 1984)**

The corporate level, in its statements about the vision of the firm and its strategic thrusts, the identified role that manufacturing should play. Business level, manager respond to the corporate objectives by assuring that all the business functions, including manufacturing, have plans consistent with the corporate vision that move the business toward the desired competitive position. Finally, functional managers must carry out designing corresponding functional programmes.

Since business level strategies are primarily a collection of well-coordinated multifunctional programmes aimed at developing and building competitiveness of the firm, as pointed out by Fine and Hax (1985, P. 30), functional strategies including manufacturing strategies are developed *primarily* at the business level. Anderson et al., (1991, p. 91) noted that business strategy, in a sense, contains manufacturing strategy and other functional strategies. Manufacturing strategy, as they pointed out, is contained within the business strategy and influences firm performance through, and as a part of business strategy. It suggests that the effective management of manufacturing strategy development is contingent and should be determined upon the overall context and configuration of business operations and the set of other functional strategies.

This conception is best captured in Fine and Hax (1985)'s definition of manufacturing strategy:

Manufacturing strategy is a critical part of the firm's corporate and business strategy, comprising a set of well-coordinated objectives and action programmes aimed at securing a long-term, sustainable advantage in production over competitors. It must be considered within the overall context of the firm's business strategy, as well as other functional strategies.

3. 6. 2. Content and Process Model of Manufacturing Strategy Development

The discussions on the formal distinction between strategy process and content can be traced to Andrews (1971), Ansoff (1965) and Chandler (1962), which will be elaborated in the next section. Business strategy researchers have long noted the distinction between research on the *process* of strategy and research on the *content* of strategy (Huff and Reger, 1987; Fahey and Christiansen, 1986).

In manufacturing strategy literature, one of the few explicit discussions of the distinction between content and process variables in the literature is in the work of Swamidass and Newell (1987). Also Adam and Swamidass (1989) assess several major contributions to the manufacturing strategy literature on the basis of process and content variables used in the studies.

➤ Content Model of Manufacturing Strategy Development

It has frequently been suggested that sustainable competitive advantage for a business unit results from building core capabilities or distinctive competencies (e.g., Hayes, 1985; Prahalad and Hamel, 1990; Stalk, Evans and Shulman, 1992). Manufacturing strategy content refers to the distinctive competences of the manufacturing function employed in the pursuit of competitive advantage (Swamidass and Newell, 1987). Manufacturing strategy content embodies both the choice of the most beneficial set of competitive priorities/capabilities of manufacturing for a business unit and the set of decisions on investments and action-programmes to build that set of capabilities (Ward et al., 1992).

The conceptual beginnings of a content framework of manufacturing strategy can be credited to the seminal work of Skinner (1969). Skinner conceived a model for manufacturing strategy in which the competitive environment suggests a basic business strategy which, in turn, suggests the manufacturing mission or strategy. This mission can be encapsulated into choices made with respect to four competitive priorities of manufacturing performance: cost, quality, delivery and flexibility. The design of the manufacturing system, production planning and control, and quality systems can then be made to fit the strategy by making appropriate tradeoffs or decisions in certain key areas. Further, Skinner suggested five areas where tradeoffs or decisions had to be made to assure a fit and integration between business

strategy and manufacturing: 1. Plant and equipment; 2. Production planning and control; 3. Labour and staffing; 4. Product design/engineering; and 5. Organization and management.

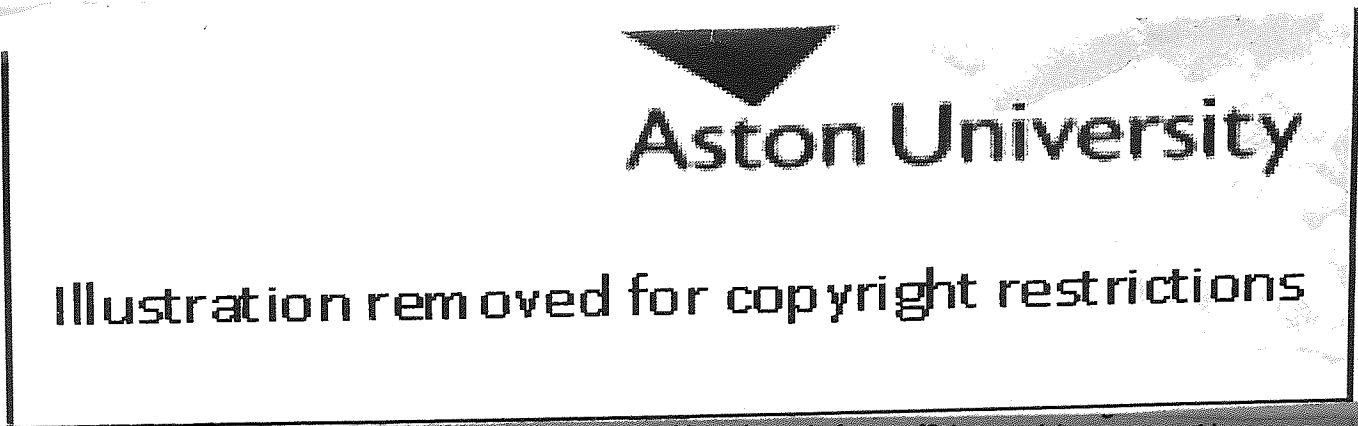
In the ensuing years, various authors have used different terms to describe the dimensions of manufacturing performance, although they have most often been referred to as competitive priorities of manufacturing (e.g., Hayes and Wheelwright, 1984). Roth and Van der Velde (1991) distinguish between intended and realized manufacturing performance by referring to the former as competitive priorities of manufacturing and the latter as competitive capabilities of manufacturing. Hill (1994) classified such manufacturing performance as order winners and qualifiers, according to their importance in gaining customers. Despite differences in terminology, general agreement exists in the manufacturing literature about the dimensions of competitive priorities/capabilities that are generic in manufacturing. A composite view from the literature (Skinner, 1969, 1978, 1985; Wheelwright, 1984; Buffa, 1984; Hayes and Wheelwright, 1984; Fine and Hax, 1985; Hayes, 1985; Van Dierdonck and Miller, 1980; Hayes et al., 1988) yields the following four dimensions of competitive priorities/capabilities of manufacturing (see Table 3.4).

There is also general agreement about the strategic manufacturing decision categories in which investments and capability-building programmes decisions are made. Hayes and Wheelwright (1984) note that the manufacturing strategy of the business unit is reflected and made operational through a series of major decisions consummated in a relatively few generic areas - manufacturing system design, production planning and control, and quality system. Different authors have offered lists of strategic decision areas for manufacturing (Skinner, 1974; Buffa, 1984; Hayes and wheelwright, 1984; Fine and Hax, 1985; Hayes et al., 1988). Ward, Miller and Vollmann (1988) find both empirical support and wide agreement in the literature for a circumscribed set of strategic decision categories in manufacturing which include:

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <ul style="list-style-type: none"> • Technology • Capacity • Facilities • Vertical Integration | STRUCTURAL |
| <ul style="list-style-type: none"> • Production and Inventory Control • Quality Systems • Manufacturing Organization • Workforce Management | INFRASTRUCTURAL |

Table 3.4 Dimensions and Descriptions of Competitive Priorities/Capabilities of Manufacturing

- A. *Cost* • All manufacturers are concerned to some degree with cost, but most do not com-



general purpose machinery instead of more efficient special purpose machinery and by deploying more highly skilled workers than would otherwise be needed.

Adopted from Adam and Swamidass (1989)

An important addition to the lists of strategic decision categories suggested by various authors is the structure-infrastructure bifurcation developed by Hayes and Wheelwright (1984). Structural decision categories addresses the “bricks and mortar” decisions of capital spending. Infrastructure decisions affect the people and systems that make manufacturing unit work. Hayes et al. (1988) suggest that the distinction between structure and infrastructure is analogous to the distinction between computer hardware and software.

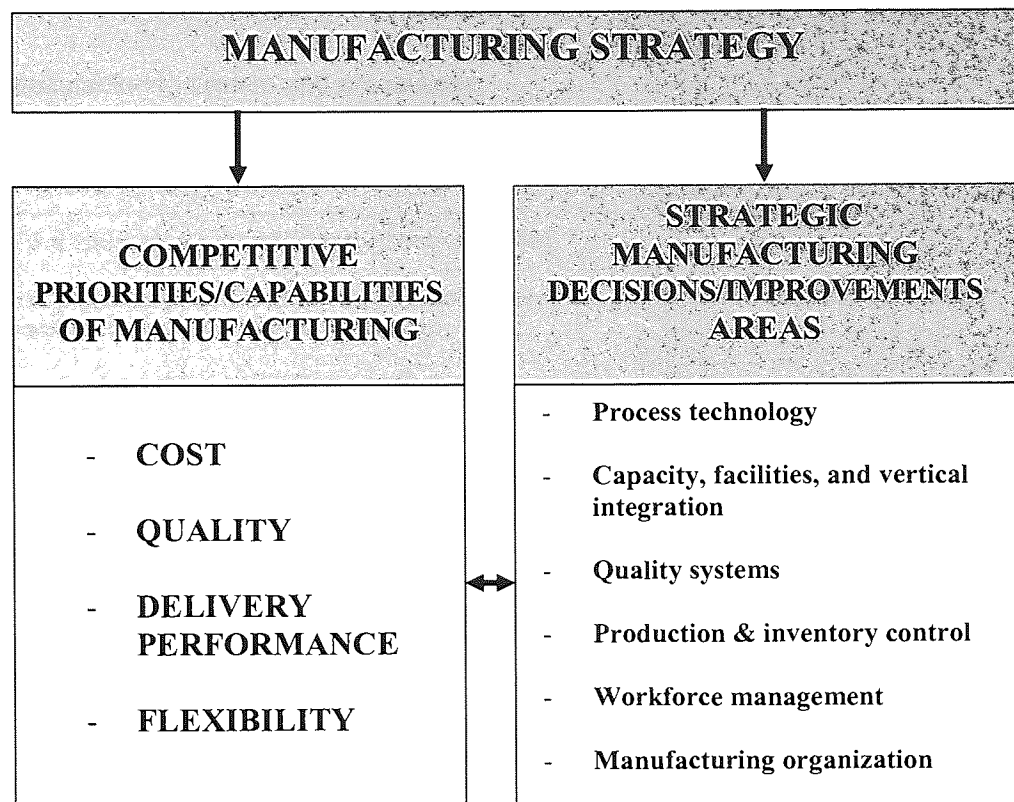
A table summarizing “content” variables identified in the literature is provided by Adam and Swamidass (1989) based on their interpretation of the literature (see Table 3.5).

Content Variables	Authors						# of times mentioned
	Hill 1985	Miller Roth 1988*	Schroeder et al 1986*	Skinner 1978	Swamidass 1986*	Wheelwright 1984	
Capacity			yes			yes	2
Cost/price/productivity	yes	yes	yes	yes	yes		5
Delivery	yes	yes		yes	yes		4
Product design and engineering	yes				yes		2
Distribution		yes					1
Employee relations			yes				1
Facilities						yes	1
Flexibility	yes	yes	yes	yes	yes		5
Focus	yes			yes			2
Infrastructure	yes						1
Quality		yes	yes	yes	yes	yes	5
Return on investment				yes			1
Service		yes	yes	yes			3
Standardization	yes						1
Technology-process	yes		yes	yes	yes	yes	5
Vertical integration						yes	1

*Empirical studies.

Based on the above review, an analytical framework of manufacturing strategy content is derived as the template of analysis for the research (see Figure 3.3). As discussed earlier, there is general agreement on the content of manufacturing strategy. The content of manufacturing strategy has been subject to much more conceptual development in the literature than context and process issues (Adam and Swamidass, 1989).

Figure 3.3 An analytical Framework of Manufacturing Strategy Content



➤ Process Model of Manufacturing Strategy Development

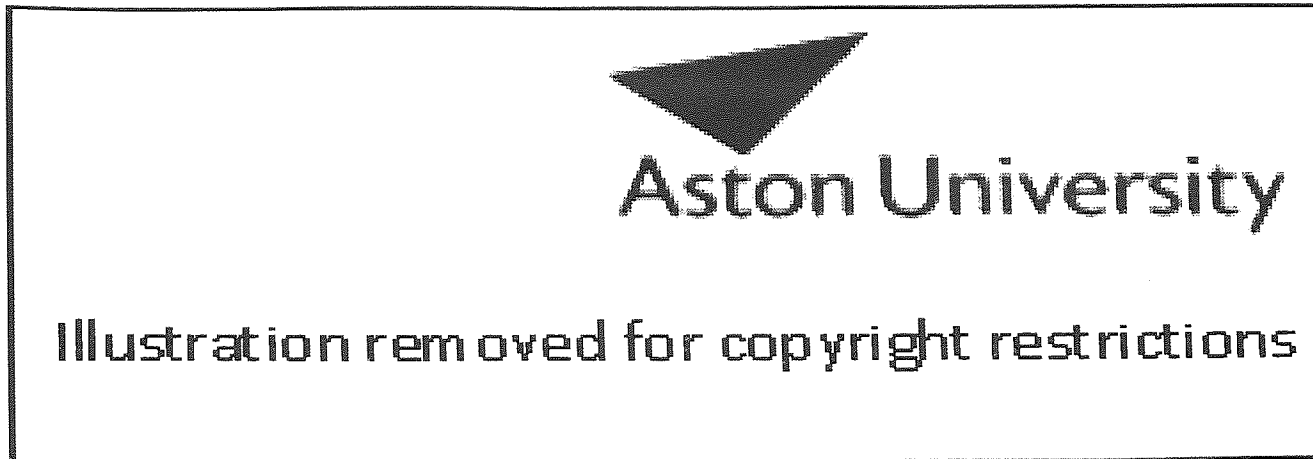
While there has been considerable research and essential agreement on the content of manufacturing strategy, there has been scant literature concerning the process of manufacturing strategy. Indeed as Leong et al (1990, p.117) suggest that manufacturing strategy process has been neglected relatively to content in both conceptual and empirical work. Several authors have identified the need to overcome this deficiency by studying the process of manufacturing strategy (Adam and Swamidass, 1989; Anderson et al., 1989 and 1991).

However several most influential contributions must be noted. The most prominent literature is the work of Skinner (1969,), who began the conceptual development of a top-down rational linear approach to defining and implementing manufacturing strategy. He provides the first and one of the few prescriptive flow diagrams of the manufacturing strategy process. Skinner (1969; 1978; 1985) outlines a Fifteen Step process model (see Table 3.6) that starts by comparing industry factors and

company characteristics to develop a corporate strategy which drives the definition of the manufacturing task, which drives the development of manufacturing policies, and then defines three requirements:

1. manufacturing system and procedures;
2. manufacturing controls; and
3. manufacturing operations.

Table 3.6 Skinner's Fifteen Steps Process Model

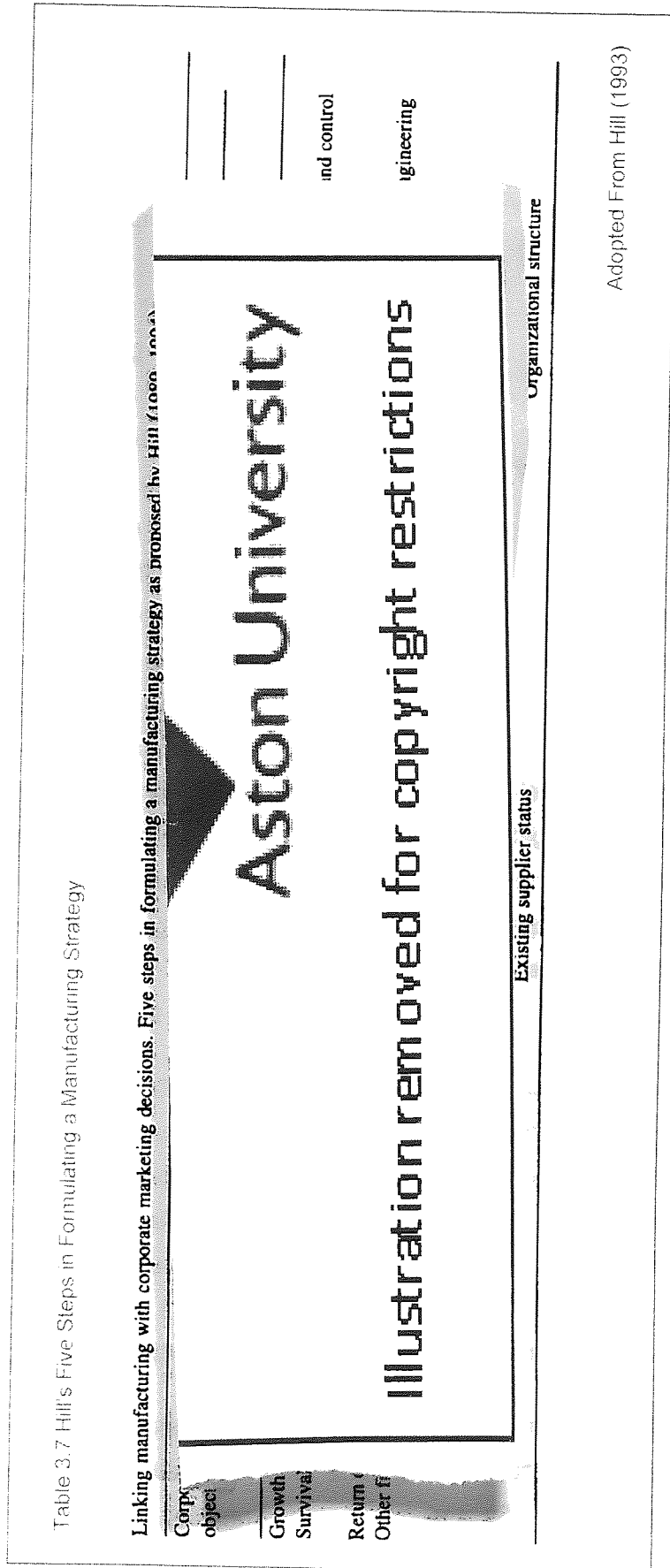


Adopted from Skinner (1985)

Other writers have added support to this top-down rational and linear approach including Miller (1981), Anderson et al (1989), and Roth (1989). Also Fine and Hax (1985) provide a conceptual framework and a set of pragmatic guidelines for designing a manufacturing strategy. As they suggest, the steps provide a 'followable' set of guideline, most of which appear to be similar to Skinner's steps mention earlier. Following a similar idea, Platts and Gregory (DTI, 1988) take the 'manufacturing audit' approach and suggest a step-by-step, worksheet-driven model to operationalise earlier strategy frameworks.

Perhaps one of the most influential and complete conceptual frameworks following Skinner's top-down rational and linear approach is developed by Hill (1989, 1994), who outlines a unique five-step process to develop a manufacturing strategy (see table 3.7). The framework focuses upon the translation of corporate policy and marketing strategy into 'process choice' and the development of the manufacturing

'infrastructure'. Central to the framework is the determination of order winning and qualifying criteria for the firm's products/services.



Hill sees nothing unique about this process from Skinner's top-down hierarchical approach of rational planning. However, he regards the current situation as one where corporate decision makers see only the first three as an iterative process with feedback loops at each stage of development. Process choice and infrastructure, the production system design issues, are simply seen as linear and deterministic by most senior executives. It is argued that manufacturing strategy (i.e. step 4 and 5) should also interact in an iterative manner with the first three steps: that manufacturing managers should enter the 'corporate debate'.

Hill's framework (1989, 1994) provides a formal analytic method for establishing a manufacturing-marketing interface. Moreover to certain extent it explores the interactive relationships from the 'bottom-up' and illustrates how excellence in manufacturing can provide order-winning characteristics for products, which may not have been recognized as winners by corporate decision makers and marketing managers. However, the essential nature of this framework is still top-down rational. It is based on the premise that manufacturing strategy should be market-led and based on analytic methodology of rational planning. Of course as the framework suggests, manufacturing can and should have a voice in setting the marketing and/or business strategy, but whatever capabilities or resources are developed by manufacturing, they should be in support of a marketing strategy. At the same time, no prescription is given about how to compete, particularly if another aggressive competitor is pursuing the same marketing/ business strategy. The best advice in this case is to be sure that manufacturing adopts the best practices and stays on the leading edges of technology, which in itself may be inadequate to attain and sustain competitive advantages in the competitive environment of Next Generation Manufacturing as revealed at outlet of this chapter.

Others have provided analytical and /or logical frameworks that one might consider as decision aids in defining and implementing manufacturing strategy; for example, Skinner's (1974) dimensions of focus; Hayes and Wheelwright' (1979) product-process matrix; Marshall and Abernathy's (1975) trade-off analysis; Cleveland et al.'s (1989) production competence analysis; Slack's (1994) importance-performance matrix; Schroeder et al.'s (1986) MOPD (Mission, Objectives, Policy and Distinctive competence); and Abernathy's (1974) learning curve analysis; to name just a few.

While along with the efforts of those above, the Skinnerian model of a top-down hierarchical approach focuses on linear strategic planning and advocates a rational and analytic view of manufacturing strategy process, which is very prevalent in the conceptual literature of manufacturing strategy process.

Another body of manufacturing strategy process research see a need for a bottom-up incremental (or interactive) approach to defining and implementing manufacturing strategy that has not been adequately considered in the literature (Hayes and Wheelwright, 1984; Hayes, 1985). Hayes and his colleagues have argued that manufacturing capability should play an important role in achieving competitive performance, and in some cases, should drive business strategy (Hayes and Clark, 1985; Wheelwright and Hayes, 1985; Hayes and Pisano, 1994). From this school of thought, it has frequently been suggested that sustainable competitive advantage for a business unit results from building core capabilities or distinctive competencies (e.g., Hayes, 1985; Prahalad and Hamel, 1990; Stalk, Evans and Shulman, 1992). The critiques to Skinnerian model also made by Miller and Hayslip (1989), who argue that first, the model suggests a hierarchical linear neatness that has not been demonstrated by empirical research; second, manufacturing strategy process should balance the use of both rational analytic planning and incremental capability building to achieve competitive advantage. The implication of their argument is that the Skinnerian process model should be revised for parallel and interactive development of conventional strategic planning along with capability building activities.

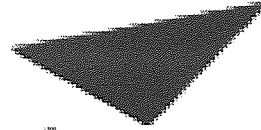
Although Hayes and Wheelwright are primarily known for their product-process matrix (1979) and the original set of eight generic categories of strategic manufacturing decision-making (1984), they were also the first to develop interactive approach to manufacturing strategy process and identify the strategic implication of manufacturing capability-building.

Furthering their development on the balance between strategic planning and capability building of manufacturing decision-making, Wheelwright and Hayes (1985) furnished a Four Stages Effectiveness model of manufacturing's strategic role in the organization, which opened up the debate on the strategic impact of manufacturing capability building and the contingent nature of manufacturing strategy process in the literature (see table 3.6). Along with this model they also provide a descriptive framework for the transition practices and challenges at each stage, which have significant implications on studying strategic change and capability building in manufacturing organization.

Table 3.8 Hayes and Wheelwright's Four Stages Effectiveness Model

The stages identified in the framework are as follows:

Stage 1: Mismatch



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executives to have a meaningful role in contributing to the development of the company and its strategies as a whole. In some cases this will result with the realisation that manufacturing is the key competitive weapon within the organization.

Adopted from Hayes and Wheelwright (1984)

The conception of manufacturing strategy defined by them emphasizes an adoptive or incremental nature of the process that it is the configuration of decisions actually made on competitive priorities and capability building, and the degree to which that configuration supports the business and other functional strategies that constitutes a manufacturing strategy.

1. A manufacturing strategy is determined by the pattern of the decisions actually made, not by what the business says its manufacturing strategy is.
2. The more consistent those decisions are, and the extent to which they support the SBU'S desired competitive advantage, the more effective the manufacturing strategy is likely to be.
3. Although individual decisions are usually driven by, and in support of, specific products, markets, or technologies, the primary function of a manufacturing strategy is to guide the business in putting together the set of manufacturing capabilities that will enable it to pursue its chosen competitive strategy over the long term.

(Hayes and Wheelwright 1984, p. 33)

From their perspective, also noted by Anderson et al., (1991), strategic planning is necessary but not sufficient. Strategic management implies consistent strategic decision-making at all levels and in all departmental units within the firm. Thus, basic to a manufacturing strategy is a conceptual framework for individuals to make decisions on how to best develop competencies and provide the prioritised manufacturing performance. Being able to move from the level of making specific decisions to developing competitive capabilities at the aggregate level – and back again – is central to managing an effective manufacturing strategy process (Hayes and Wheelwright, 1984).

The process variables (see Table 3.9) identified in the manufacturing strategy literature are summarized by Adam and Swamidass (1989).

Table 3.9 Manufacturing Strategy Process Variables in the Literature

Process Variables	Authors					
	Hill 1983	Miller Roth	Schroeder et al.	Skinner 1978	Swamidass 1985	Wheelwright 1985
Manufacturing Infrastructure						
Manufacturing Task						
Order Winning Criteria						
Role of Manufacturing Managers						

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*Empirical studies.

Adopted from Adam and Swamidass (1989)

The variable Manufacturing Infrastructure is the “internal systems” of manufacturing organization including “organizational levels, wage systems, supervisory practices, production control and scheduling approaches, and job design ...” (Skinner, 1978, p.45) through which actual production is carried out. Manufacturing Task is a clear and concise statement of “what the manufacturing function must accomplish,” which includes specific goals and priorities for manufacturing function (Skinner, 1978). The variable Order Winning Criteria was proposed by Hill (1993) as essential to manufacturing process. The variable Role of Manufacturing Managers refers to the importance of the role of manufacturing managers in strategic making (Skinner,

1978; Swamidass and Newell, 1987). The variable Defining Manufacturing Strategy refers to the way of conceptualisation of manufacturing and the essential paradigm of manufacturing strategy process (Skinner, 1978; Hayes and Wheelwright, 1984).

Those various types of internal and external consistency provide the criteria for evaluating a given manufacturing strategy (Skinner, 1978; Hayes and Wheelwright, 1984). These criteria have fully demonstrated those underlying conceptions of manufacturing strategy reviewed earlier in the section. For the strategic management of manufacturing, manufacturing decision-making has to be carried beyond the boundaries of production organization and considered in its overall strategic context of the business. Internal consistency of manufacturing strategy is a fundamental requirement for the strategic management, but it contributes only as initial stages of manufacturing's competitive capability building (Wheelwright and Hayes, 1985).

There is no apparent pattern in the frequency of variables identified in the literature, indicating limited consensus on the process of manufacturing strategy development in the field. In fact, debate surrounding the efficacy of different process paradigm (i.e. top-down versus bottom up; formal planning versus incremental capability building) has arisen and promising research has been started. Marucheck et al. (1990) surveyed managers' views of the manufacturing strategy process and the effectiveness of formalized procedures. Lindberg (1990) and Tunalv (1990) explored the effects of manufacturing problems and organizational decentralization on the strategy process. However, many of these studies on exploring and delineating the empirical paradigm of manufacturing strategy process are still in isolated manner and largely providing analytic tools and decision aids and have not been incorporated into existing process model providing multidimensional conceptualisation on the situational nature of the manufacturing strategy process. What seems critical, pointed out by Anderson et al (1991) is to develop further our understanding of the multidimensional and integrative conceptualisation of the manufacturing strategy process. There is critical need in the existing process model for a "synthetic" perspective for guiding management in making strategic manufacturing decisions.

3. 6. 3. Limitations in the Existing Paradigm of Manufacturing Strategy

Summarize thus far, from a theoretical perspective there is much less emphasis in the existing paradigm on the organizational processes involved in manufacturing strategy development and the “synthesis” linking mechanism required (Anderson et al., 1991, p.89). What seems critical, pointed out by Anderson et al., is to develop further our understanding of the multidimensional conceptualisation of the manufacturing strategy development practice. Also as Swink and Way (1994) suggest that the essential challenge which faces manufacturing strategy researchers is to identify and characterize the environmental and organizational contingencies in the paradigm of manufacturing strategy development and to provide a substantive contextual understanding for operationalising the underlying concepts of manufacturing strategy. Many of the linking mechanisms and multidimensional profiles demonstrated in the business strategy literature remain unexplored in manufacturing strategy research. The multifaceted and situational nature of the strategy development practice has been almost neglected in manufacturing strategy literature compared to business strategy literature.

Perspectives regarding the overall paradigm of manufacturing strategy development have been fallen in line with several dialectics: e.g., top-down versus bottom-up, centralization versus decentralization, market-led versus capability-led. In short, as pointed out by Anderson et al (1991), there is an urgent need of research to explore, delineate, and explain the empirical management paradigms of how manufacturing strategy is actually developed in the contemporary organization and reconcile those different perspectives into a multidimensional and integrative profile of manufacturing strategy development. It should focus more on the interpretation of managerial perceptions, and social, cultural, political and cognitive aspects of manufacturing decision-making rather than the unitary rational planning explanation.

There are also several shortcomings regarded to the overall status of the existing paradigm of manufacturing strategy development that have been identified by researchers in the field:

- Lack of meta-analysis of published studies in the field. Such an analysis, suggested by Ward (1990), should include a methodological profile of existing studies. Such meta-analysis also should allow researchers to determine which issues appear to be solidly studied and which area require more development. This is particularly important since the preponderance of

empirical research has thus far focused on a single area: the content of manufacturing.

- As noted by Flynn et al. (1990), researcher in the field of manufacturing strategy have been casual about establishing their work in the context of what has been previously done and written. In order for the field to progress research must be done to identify and define major constructs especially regarding the process of manufacturing strategy.
- In large part, manufacturing strategy has developed independently from related streams of social and organization sciences, such as organization theory, industrial organization economics and even business strategy. Key concepts and major constructs have been well developed in business strategy literature especially on the strategy process. As Ward et al (1990) and Adam and Swamidass (1989) noted that manufacturing strategy researchers should integrate and build upon concepts, constructs, and themes developed in the business strategy area.

3. 7. An Analytic Review on Research Methods and Focus of Previous Empirical Studies

Adam and Swamidass (1989) and Minor et al (1994) pointed out that the theoretical development of manufacturing strategy seems to be endlessly stalled for want of high quality empirical research. They regarded this as the main reason for the limitations in the existing paradigm from a theoretical perspective just reviewed. This section will provide a brief review on empirical studies in the manufacturing strategy literature of 1980s and 1990s.

The author acknowledged the limitation of the comprehensiveness for the review because the review strategy only included those journals that typically have been the central outlets for the research in manufacturing strategy area. There are many other outlets for manufacturing strategy publications and manufacturing strategy research in the pipeline has not been included. But as the title of this section suggests that the purpose here is to provide an analytical picture on the status of research focus and methods applied in empirical manufacturing strategy studies rather than a rigorous review to evaluate and classify the literature itself. Therefore, with a clear focus and acknowledgement of the limitation, it does, to certain extent, provide an objective picture of the subject status. Based on such picture, the critical analysis and informative suggestions will be provided by the author with incorporating critiques and commends from those leading scholars in the field.

3. 7. 1. Strategy of the Review

Frameworks for the comparison of empirical research have appeared frequently in the business strategy literature. They have proved to be a valuable means of comparing a large number of studies that are focused on a common topic. For example, Armstrong (1982) classified studies, which addressed the value of formal planning processes according to treatment, conditions, and results. Armstrong solicited the assistance of the authors of each study as part of the classification process. Robinson and Pearce (1984) reviewed the small firm strategic planning literature. Studies were classified according to sample size, type of business, study focus, methodology, and findings. Pearce *et al.* (1987) reviewed 18 empirical studies, which examined the relationship between formal planning and financial performance. Studies were first categorized according to planning formality, source of data, results, contribution, and other factors.

After reviewing the frameworks used in the classification and comparison of business strategy literature, a review strategy was developed for reviewing empirical manufacturing strategy studies. In developing the strategy, two concerns were given priority. First, the strategy had to facilitate comparison of methodological details such as data collection method, essential nature of the evidence, and type of industry. Second, it should allow for accurate assessment of predominant focus of the studies such as process issues or content issues.

Given the constraint of time and accessibility, the review focused on only those journals that typically have been the central outlets for manufacturing strategy research (see Table. 3.10).

Table 3.10 Reviewed Journals

Operations and Production Journals

- International Journal of Operations and Production Management
- Journal of Operations Management

Management Science Journals

- Decision Science
- Interfaces

General Business Strategy Journals

- Strategic Management Journal
- European Management Journal

These six journals have been regarded as central outlets of and used as essential reviewing lists by Meredith et al. (1990)'s review, Flynn et al. (1990)'s review, Swamidass (1991)'s review, and Minor et al. (1994)'s review on manufacturing strategy literature.

The articles were identified by an extensive manual search of each journal. The abstract of each article was reviewed as to the article's possible use of an empirical research method and its fit in the manufacturing strategy literature. The full article was reviewed if there were further questions about the article. An article identified as having a manufacturing strategy topic and using empirical research methodologies was then reviewed in its entirety. In the in-depth review, the research method and

focus were identified. If the focus of the article was process issues of manufacturing strategy, a brief description of the research was to be presented.

The definition of *empirical research* used in this review is similar to the definition presented by Flynn et al. (1990). Briefly, the term of empirical research refers to research that makes use of data that is derived from naturally occurring field-based investigation, taken from industry. This is contrast to research that is conducted in either a laboratory setting, by mathematical modelling, or using simulation models (Flynn et al., 1990).

Research characterized as *content* research of strategy has been focused on the subject of the *strategic decision* itself, decisions on strategic goals and objectives, course and programmes of actions, priorities of resource allocation and capabilities building. In the last decade, considerable attention has been devoted to learning more about merger, acquisition, and divestment strategies; entry, exit, and mobility barriers; product/market differentiation; turnaround; vertical integration and similar subjects. Content research has focused on linking specific decisions and broader economic structures to performance outcomes. It has also given considerable attention to defining similarities and differences among strategic units within the firm, among strategic groups within industries, and among firms in similar circumstances, such as growth or decline in demand.

Process research of strategy, in contrast, has been defined as research primarily focused on the actions that lead to and support strategy. Research in this area has included prescriptive and descriptive work on planning approaches and decision-making framework; with attention directed toward the effectiveness of alternative means for developing and implementing strategy. The impacts of individual and group characteristics and organizational structure on the formation and implementation of strategic decisions have also concerned researchers in this area.

Another related also important note is, as suggested by Yin (1994, p.14), that *qualitative* and *quantitative* research should be distinguished on the basis of the essential type of evidence used for data collection.

3. 7. 2. Research Focus and Methods of Previous Empirical Studies

Investigators	Cross-sectional / Longitudinal	Manufacturing / Service	Sample Industry
1. Hayes and Clark (1985)	Longitudinal	Manufacturing	Cross Industry
2. *Fine and Hax (1985)	Cross-sectional	Manufacturing	Electrical Supply
3. Richardson et al. (1985)	Cross-sectional	Manufacturing	Electronics
4. Ferdows et al. (1986)	Cross-sectional	Manufacturing	Cross Industry
5. Swamidass (1986)	Cross-sectional	Manufacturing	Machine Tools
6. Schroeder et al. (1986)	Cross-sectional	Manufacturing	Cross Industry
7. Swamidass and Newell (1987)	Cross-sectional	Manufacturing	Machinery
8. *Cleveland et al. (1989)	Cross-sectional	Manufacturing	Cross Industry
9. De Meyer et al. (1989)	Cross-sectional	Manufacturing	Cross Industry
10. Schroeder et al. (1989)	Cross-sectional	Manufacturing	Cross Industry
11. Tunalv (1990)	Cross-sectional	Manufacturing	Swedish engineering
12. Maruchek et al. (1990)	Cross-sectional	Manufacturing	Cross Industry
13. Lindberg (1990)	Cross-sectional	Manufacturing	Cross Industry
14. Ferdows and De Meyer (1990)	Cross-sectional	Manufacturing	Cross Industry
15. *Anderson et al. (1991)	Cross-sectional	Manufacturing	Cross Industry
16. De Meyer and Ferdows (1991)	Cross-sectional	Manufacturing	Cross Industry
17. Horte et al. (1991)	Cross-sectional	Manufacturing	Cross Industry
18. Lindberg and Trygg (1991)	Cross-sectional	Manufacturing	Cross Industry
19. *Prochno and Correa (1995)	Longitudinal	Manufacturing	Machinery
20. Noble (1995)	Longitudinal	Manufacturing	Cross Industry
21. Ward (1995)	Cross-sectional	Manufacturing	Cross Industry
22. Williams et al. (1995)	Cross-sectional	Manufacturing	Textile
23. Kotha and Vadlamani (1995)	Cross-sectional	Manufacturing	Cross Industry
24. Kotha and Nair (1995)	Longitudinal	Manufacturing	Machine Tools
25. Kim and Arnold (1996)	Cross-sectional	Manufacturing	Cross Industry
26. Ahmed and Montagno (1996)	Cross-sectional	Manufacturing	Cross Industry
27. Boyer et al. (1996)	Cross-sectional	Manufacturing	Cross Industry
28. Dean et al. (1996)	Longitudinal	Manufacturing	Cross Industry
29. Noble (1997)	Cross-sectional	Manufacturing	Cross Industry
30. *Rafael and David (1997)	Cross-sectional	Manufacturing	Cross Industry

31. Ward (1998)	Cross-sectional	Manufacturing	Cross Industry
32. Voss (1998)	Cross-sectional	Manufacturing	Cross Industry
33. Tracey (1999)	Cross-sectional	Manufacturing	Cross Industry
34. Boyer (1999)	Cross-sectional	Manufacturing	Cross Industry
35. Smith (1999)	Cross-sectional	Service	Distribution Service
36. Michael (1999)	Cross-sectional	Manufacturing	Cross Industry
37. **Pyke et al. (2000)	Cross-sectional	Manufacturing	Cross Industry
38. Ward (2000)	Cross-sectional	Manufacturing	Cross Industry
39. Kotha (2000)	Cross-sectional	Manufacturing	Cross Industry

Investigators	Data Collection Method *	Essential Type of Evidence (Qual / Quant)	Focus of the study Content / Process
1. Hayes and Clark (1985)	Field Study	Quant	Content
2. *Fine and Hax (1985)	Case Study	Qual	Content/Process
3. Richardson et al. (1985)	SQ	Quant	Content
4. Ferdows et al. (1986)	MFSP	Quant	Content
5. Swamidass (1986)	SQ and MFSP	Quant	Content
6. Schroeder et al. (1986)	SQ	Quant	Content
7. Swamidass and Newell (1987)	SQ and MFSP	Quant	Content
8. *Cleveland et al. (1989)	I	Qual	Process
9. De Meyer et al. (1989)	MFSP	Quant	Content
10. Schroeder et al. (1989)	SI	Qual	Content
11. Tunalv (1990)	SQ	Quant	Content
12. Maruchek et al. (1990)	FO and I	Qual	Process
13. Lindberg (1990)	SQ	Quant	Content
14. Ferdows and De Meyer (1990)	MFSP	Quant	Content
15. *Anderson et al. (1991)	SQ	Quant	Process
16. De Meyer and Ferdows (1991)	MFSP	Quant	Content
17. Horte et al. (1991)	SQ	Quant	Content
18. Lindberg and Trygg (1991)	SQ	Quant	Content
19. *Prochno and Correa (1995)	FO	Qual	Process
20. Noble (1995)	Archival Research	Quant	Content
21. Ward (1995)	SQ	Quant	Content

22. Williams et al. (1995)	SQ	Quant	Content
23. Kotha and Vadlamani (1995)	SQ	Quant	Content
24. Kotha and Nair (1995)	SI/Documents	Quant	Content
25. Kim and Arnold (1996)	MFSP	Quant	Content
26. Ahmed and Montagno (1996)	SQ	Quant	Content
27. Boyer et al. (1996)	SQ	Quant	Content
28. Dean et al. (1996)	SQ	Quant	Content
29. Noble (1997)	SQ	Quant	Content
30. *Rafael and David (1997)	I and FO	Qual	Process
31. Ward (1998)	SQ	Quant	Content
32. Voss (1998)	SQ	Quant	Content
33. Tracey (1999)	SQ	Quant	Content
34. Boyer (1999)	SQ and SI	Quant	Content
35. Smith (1999)	SQ and Documents	Quant	Content
36. Michael (1999)	SQ	Quant	Content
37. **Pyke et al. (2000)	SQ	Quant	Content/Process
38. Ward (2000)	SQ	Quant	Content
39. Kotha (2000)	SQ	Quant	Content

*Data collection method: SQ = Survey Questionnaire; I = Qualitative Interviews; SI = Structured Interviews; FO = Field Observation; MFSP = Manufacturing Futures Survey Project data.

Among the total 39 empirical studies identified, there are only 6 of them related to the process issues of manufacturing strategy development. This clearly justified the *content bias* of manufacturing strategy research in the literature revealed in previous section. Also as we shall see, even among these six *process studies* the multifaceted and situational nature of strategy process has been almost neglected.

Fine and Hax (1985) study co-ordination of manufacturing strategy process with other functional and business strategies. Cleveland (1989) studies production competence and its relationship to strategy process and performance. Prochno and Correa (1995) study the proactivity of manufacturing strategy process in the international context of Brazil and other turbulent environment. Rafael and David (1997) study the effective link between manufacturing strategy process and marketing strategy using Hill (1989)'s model. Pyke et al. (2000) is the ONLY

empirical study identified within these central outlets of manufacturing strategy publications that is research on manufacturing strategy in China and related to manufacturing strategy development in China's SOEs. As Pyke et al (2000, p.576) note in the conclusion remarks that SOEs are far more involved and advanced in using explicit competitive and manufacturing strategy concept than had been anticipated. The manufacturing strategy process is also far more complex, intertwined, multifaceted and context-specific that had been reported. But they only identified that most of those SOEs in their survey are at the stage 2 and stage 3 of Wheelwright and Hayes (1985)'s Four Stages Effectiveness Model and focused mainly on discovering the differences among ownership types (State-, Collective- and Private- Owned enterprises).

However, limitation of the review outcome is that only one reference is made to previous manufacturing strategy research in China. The scope of the review has then been expanded on this regard. A further search on **ProQuest/ABI INFORM Global** and **Business Source Premier (Ebsco)** for peer-reviewed publications until 2001 has been conducted using the key words 'China' and 'Manufacturing/Production'. Several new references have been made. Among them the following articles, from their own research angle, have been closely reflecting the changing competitive environment and the current management activity (perspective and practice) in manufacturing in China. Taking in aggregate, they have all addressed the critical need of further research into the contemporary paradigm of strategic manufacturing management in practice in China.

Published in the International Journal of Production Economics, the paper of Robb and Xie (2001) "A Survey of Manufacturing Strategies in China-based Enterprises" presents the results of a 1997 study exploring the manufacturing strategy of 46 plants (foreign-invested enterprises (FIEs) and wholly Chinese-owned enterprises (WCOEs)) located primarily in the Beijing–Tianjin area. Survey questionnaires in English and Chinese were employed to: (i) identify current activity and future trends in manufacturing, (ii) compare and contrast FIEs and WCOEs, and (iii) identify how practices correspond with performance on various competitive objectives and overall performance. In the concluding remarks they suggest that in addition to cost competitiveness more attention (practice and emphasis) has been paid by WCOES to quality and delivery performance of the business operations across-the-board. They called for future research to investigate the strategic initiatives in practice, which enabled high performing WCOES to concurrently improve on both competitive dimensions (cost/differentiation).

Published in the International Journal of Manufacturing Technology and Management, the paper of Solis *et al.*, (2001) "The Best Quality Management Practices in Small and Medium Enterprises: an international study" presents a survey research conducted in five countries (USA, India, **China**, Mexico and Taiwan) to assess the quality management practices in small and medium size companies. The findings reveal that very high levels of common quality practices exist in terms of top management support, strategic quality planning, customer orientation and quality citizenship. However, common weaknesses among the top quality companies exist in relation to the human resources aspects of quality management.

Published in the Total Quality & Business Excellence, the paper of Hua *et al.*, (2000) "An Empirical Study on Quality Management Practices in Shanghai Manufacturing Industries" reports the main findings based on the survey study of 71 Shanghai manufacturers conducted in 1998. Focus is on several relationships, such as the relationship between total quality management (TQM) practices and business results, between ISO 9000 stands and TQM, and between employee involvement and TQM results. The study found that Shanghai manufacturing industries have practised quality management programmes extensively in recent years. Nearly every respondent in the survey had implemented certain kinds of quality systems and programmes. Top management in these companies regarded quality management as an essential factor for the survival and development of their companies. In general, the quality management system implemented by Shanghai manufacturers is effective and many quality benefits have been, such as better product quality, higher customer satisfaction and stronger competitiveness. However, there are also some problems in quality management in Shanghai manufacturers. For instance, the study found that many companies generally lack a long-term strategic vision in quality improvement and did not put much emphasis on employee education and training. Therefore, there has been a weak quality consciousness of the people in Shanghai organizations, particularly at operation level. Moreover, employees and suppliers were seldom invited by management to discuss quality issues, make a quality plan and design a quality programme. In order to understand further the problems and subsequently develop solutions, they called for more systematic and comprehensive studies to explore further the quality management domain in China. In particular, to illustrate more deeply the details of how quality management practices have conceived at strategic level.

Of special note, more recently, in 2002 and 2003, in the International Journal of Technology Management there have been several references addressed the effective use of technology in the strategic management of manufacturing and operations. The paper of Chanaron, Jolly and Soderquist (2002) "Technology Management: a tentative research agenda" identifies, among others, three areas of special future interest:

- Introduction of new technology in existing production processes
- Interplay between production (product/process) technology and people (management/workforce)
- Impact of new production technology on competitive performance and strength.

These are particular relevant in the context of Chinese SOEs in view of the current new wave of technological advancements and production modification following the "gaizao" initiative of MES reform. Given the high capital outlay for imported technologies and facilities, it was widely evident that an impetus has emerged for further improving technical competences in operating 'efficiency' of SOEs in China. However, following this government driven initiative, management activity and development effort has been concentrated to the detriment upon the issues of transforming advanced technologies into "rated" production power, which often overlooked the critical need to improve human-based competences and "know how" in 'effectively' operating and managing installed advanced technologies in view of the impact on competitiveness of business operations.

The paper of Steven et al., (2002) "The Evolution of Technology Management Practice in Developing Economies: findings from Northern China" presents the results of a survey study of 201 small and medium sized enterprises located in Northern China. Most of the firms in the study are evolving away from a competitive advantage based on low cost labour to developing lean competitiveness through strategic investment in advanced production technology. This change of focus away from a reliance on low cost labour is important, due to the experience of countries like South Korea that have seen a migration of foreign investors in certain industries to countries like China in response to a gradual increase in wage rates. Tactics that firms studied are currently using to gain new competitive advantage included: ISO 9000 certification, climbing the technology ladder, application of MIS and customer driven supplier partnerships.

The paper of Huang et al., (2002) "Managing New Product Development in the Chinese Steel Industry" reports the research findings based on the survey study of 190 practitioners from 18 Chinese steel companies. The study found that on the one hand, respondents ranked understanding users' need as the most important factor influencing the new product development (NPD). Further, formulating new product strategy and strengthening market/commercial research are perceived as the most important managerial functions in NPD. However, the study also found that the importance and use of technically-related measures of NPD rated above both market-related and financially-related measures. This reflects the difference between what managers recognise as the correct path to compete in a market-based economy and the current reality of management practice. More attention, as they argued, should be paid by the Chinese steel companies to achieving a balance between technical excellence, user satisfaction and profits when managing and measuring the success of NPD. Further, for the management, they suggest that more effort should be devoted to formulating new product strategy. As China is trying to compete in the global market, it is urgent for the Chinese steel industry to adopt strategic management in NPD and manufacturing.

3. 7. 3. Critical Analysis and Informative Suggestions

In the preceding section, empirical studies in manufacturing strategy literature have been briefly examined and focused review and analysis on those process related studies have been presented. Base on the picture emerged, in this section, a critical analysis and informative suggestion will be provided by the author with incorporating critiques and comments from those leading scholars in the field.

- **Cross sectional bias**

Only 4 out of 39 empirical studies identified are longitudinal research. As pointed out by Ward (1990), research on manufacturing strategy specially the process of manufacturing strategy required examination of longitudinal data. There is a critical need for more longitudinal studies in order to examine how manufacturing strategy is develop, adopted, and modified over time in the actual context of business and to develop multidimensional conceptualisation and profile of manufacturing strategy process. As Huff and Reger (1987) suggest in their review of strategy process that by studying firms in a longitudinal design, researchers have began to understand how rational planning and incremental political actions combine to influence strategy process over time.

- **Lack of cross-functional integration**

Among those 39 studies identified, researchers have widely noted that a paradigm shift that may be termed *integrated manufacturing* is occurring within organization. Integrated Manufacturing (IM) is driven by the widely spread adoption of Advanced Manufacturing Technology (AMT), Total Quality Management (TQM), and Just-In-Time management (JIT). With the increasing importance of IM, manufacturing organizations raise some basic questions as to the strategic implications and use of the IM. As pointed out by Minor et al. (1994), cross-functional relationships especially cross-functional information exchange and interactions within the development process of manufacturing strategy are of significant implications to the effective management of manufacturing strategy process.

- **Lack of integration with business strategy literature**

Finally, as the concluding remark, the integration of concepts, constructs, and methods developed in business strategy literature promises to greatly speed progress in manufacturing strategy research (Ward et al. 1990, p. 196). Amundson (1998) has argued that, by learning from related disciplines, researchers can exercise prudence without painfully 'reinventing the wheel'.

- **Unit of analysis**

Among those 39 studies identified, different units of analysis have been used by the various researchers. Although, manufacturing strategy is developed at all three levels of corporate, business, and functional, it has been widely agreed as revealed in previous section that it is developed primarily at business unit level (Fine and Hax, 1985; Schroeder et al., 1986; and Hayes and Wheelwright, 1984). More care, as pointed out by Ward et al. (1990), is called for in empirical studies to establish the appropriate unit of analysis and to acknowledge the units of analysis in comparison and generalization of the research findings.

- **Lack of common terminology**

Anderson et al. (1989) and Ward et al. (1996) pointed out that, in order to advance the field, manufacturing strategy researchers must coalesce the various definitional concepts into emergent theoretical themes, especially when defining the process of manufacturing strategy development. They argue that the practical applicability of manufacturing strategy research will be greatly increased if a common language is developed between organizational and manufacturing strategy researchers.

3. 8. Conclusion

In the foregoing seven sections this chapter had demonstrated how research questions are defined using the triangulation of three major sources - the contemporary literature, "pre-research" field investigations, and specialists' suggestions in the academic institution. The type of research questions and their substances and characteristics had directed this study towards empirical investigations incorporating case study research method. For case studies, conducting preliminary theoretical design is essential, whether the ensuring case study's purpose is to develop or to test theory. From the methodological point of view it is important to have a deep understanding on the theoretical foundations of the phenomenon under investigation so that one can effectively justify the nature of the research (exploratory, descriptive, or explanatory) and facilitate choosing a research design and methods by which objectives of answering research questions can be fulfilled.

The theoretical foundations for manufacturing strategy had then been articulated, through which the "exploratory" nature of the research was further justified from the perspective of literature review. In summary, from the existing paradigm of manufacturing strategy in the literature, there has emerged a deficiency of the multidimensional and integrative profile from a theoretical perspective when operationalising the underlying concept of strategic manufacturing management. This deficiency has been reflected through its advocated content and process models for developing manufacturing strategy. Through examining previous empirical studies in the literature, there has also emerged a very limited scale and scope of empirically developed and tested contextual contingency for its application within the contemporary industrial organizations particularly regarding its methodologies for developing manufacturing strategy.

The exploratory nature of this project has been, therefore, justified from both the critical literature review and the pre-research field investigations. From this it is clear that there have been only few previous studies on the subject of 'contemporary management paradigm of manufacturing strategy development' in the literature both English and Chinese. The levels of uncertainty and general ignorance about the phenomenon in question are at their highest level and current perspectives on the subject emerged to be inadequate. None of these few previous studies was taking a configuration approach and there is no published research, at least no direct studies, on the subject has been done in the chosen population of the thesis.

4. Theoretical Framework of the Research

4. 1. Introduction

Research questions posed in chapter 3, capturing what the study is really interesting in answering, led research to the case study method as the appropriate strategy in the first place. Nevertheless, these research questions do not point to what the research should study in order to answer them. As Yin (1994, p.21) suggests that only if researcher is forced to construct "theoretical framework" will research move in the right direction. Theoretical framework, as Yin suggests, explains (either graphically or in narrative form) the main things to be studied within the scope of the research and the angle of research to be applied for studying them. In other words, it defines the 'theoretical perspective' and 'theoretical design' for the research. 'Theoretical design', as suggested by Yin, defines the major constructs, variables, and propositions of causal relationships that should be examined with the scope of the study in order to answer those questions of the research. At the same time, as Yin noted, some studies may have a legitimate reason for not having any proposition of causal relationships between constructs and variables. This is the condition in which a topic is the subject of "exploratory research" as in this project. Every exploratory research, however, should still have a framework and template of analysis, which Yin (1994, p. 23) termed a "preliminary framework of analysis". Instead of stating propositions, the framework of analysis for an exploratory case study should include:

- What are to be explored – key issues and major constructs should be examined within the scope of the research.
- A blueprint for empirical investigation – a conceptual framework of analysis, which defines operational items in empirical exploration and facilitates data collection, e.g., essential content elements of manufacturing strategy, critical contextual aspects of consideration with respect to manufacturing strategy development, essential facets of investigation revealed in the literature for delineating strategy process.
- Template of analysis for analytical generalization – a previously developed characteristics statement used as a template with which to compare the empirical results of the case study. If two or more cases are shown to support the same characteristics, replication may be claimed.

Given the critical deficiency of a multidimensional and integrative profile in the existing paradigm from a theoretical perspective identified in Chapter 3, the author follows the suggestion from many others to integrate concepts, constructs, and essential facets of investigation from the business strategy literature to study the strategy development practice for manufacturing. However, the construction of framework of analysis is firmly based on the theoretical foundation for manufacturing strategy reviewed in the previous chapter. In so doing, the empirical study could not only benefit from those well-established themes on the paradigm of strategy development in the business strategy literature but also reflect the essential characteristics and critical need of manufacturing strategy.

4. 2. Theoretical Perspective of the Research

No discipline within the extensive field of business studies has received more attention in recent times than what has come to be called strategic management of business operations (Moore, 1992). Strategic management, whether traced from its presumed ancestry in ancient Greece or China (e.g. Ansoff, 1965), from developments in the mid-nineteenth century in North America (Chandler, 1962 and 1977), from the evolution of the 'policy' concept (e.g. Sloan, 1963); or from the industrial economics of the post-World War II era (Rumelt et al., 1994), is shown to be made up of a startling variety of definitions, theories and approaches. Virtually everyone writing on strategy agrees that it does not have one universal "best way" of operationalising the concept of strategic management neither in the *content of strategy* nor in the *process of strategy* (Rumelt, 1974; Hofer and Scheindel, 1978; Bourgeois, 1984; Gupta, 1984 and 1987).

Hambrick (1983) suggested that this lack of consistency is due to two factors. First, he pointed out, the nature of strategic management practice is multifaceted. Second, strategy content and process must be situational in relation to the specific occurring context.

In order to study this multifaceted and situational nature of strategic management practice, Miller (1986) and Miller and Mintzberg (1983) suggest a contingent and integrative view in defining theoretical perspective for the empirical research.

In defining theoretical perspective of the research this section will progress through four analytical phases:

1. Multidimensional conceptualisation of strategy
2. Theoretical foundations for strategic management
3. Configuration perspective of strategy development
4. Defining theoretical perspective of the research

4. 2. 1. The Multidimensional Conceptualisation of Strategy

Hax and Majluf (1990) suggested that, in order to study the multifaceted and situational nature of strategy, one must incorporate all different definitions and characteristics of strategy offered by the leading scholars in the field and synthesize them into an integrated conception of the subject. Mintzberg (1990), Whittington (1993) and de Wit and Meyer (1998), to name only a few, also gave the same suggestion for research in identifying and characterizing the critical dimensions of the nature of strategy.

Different authors who have defined strategy have given selective attention to the various dimensions of the concept. In reviewing some of the most important and influential works in the field of business strategy, seven critical dimensions of the concept of strategic management have been identified and characterized.

- First, strategy as a coherent, unifying, and integrative pattern of decisions

This dimension of the concept of strategy is captured in the work that took place at the Harvard Business School in the early 1960s, led by Kenneth Andrews and Roland Christensen. At a time when management thinking was oriented toward individual functions such as marketing, production, and finance, Andrews and Christensen identified a pressing need for a *holistic* way of thinking and managing business operations. They articulated the concept of strategy as a tool for doing so. Andrews and Christensen saw strategy as the unifying idea that linked together the functional areas in a company and related its activities to its operating context (Andrews, 1971). The works of Andrews and Christensen, along with that of others such as Igor Ansoff, Alfred D. Chandler, Peter F. Drucker, propelled the notion of strategy into the forefront of management practice.

- Second, strategy as a means of establishing an organization's purpose in terms of its long-term objectives

This classical view looks at strategy as a way of explicitly shaping the long-term goals and objectives of an organization; of defining the major action programmes needed to achieve those objectives; and resources allocation priorities. This dimension of the concept of strategy emanated quite explicitly from the definition given by Chandler (1962):

"Strategy is a determination of the basic long-term goals of an enterprise and the adoption of courses of actions and the allocation of the resources necessary to carry out these goals" (p.13).

- Third, strategy as a definition of a firm's competitive domain

It has long been recognized that one of the central concerns of strategy is defining the business a firm is in or intends to be in. This dimension of the concept of strategy is captured in one of the

earliest and most influential books in the field by Learned, Christensen, Andrews, and Guth's, *Business Policy: Text and Cases* (1965):

"Strategy is the pattern of objectives, purposes or goals and major policies and plans for achieving these goals, stated in such a way as to define what business the company is in or is to be in and the kind of company it is or is to be" (p.17).

- Fourth, strategy as a response to environmental opportunities and threats and to organizational strengths and weakness as a means of achieving competitive advantage

Argyris (1985) reflects this dimension of the concept of strategy:

"Strategy formulation and implementation include identifying opportunities and threats in the environmental context of the firm, evaluating the strengths and weaknesses of the organization, designing structures, defining roles, hiring appropriate people, and developing appropriate rewards to keep those people motivated to make contributions" (p.1).

Some authors emphasize more strongly the need for organizations to obtain *viable matches* with their environments. In this case, the central role of strategy is not viewed as just passively responding to the opportunities and threats presented by the external environment, but as continuously and actively building and adapting the organization and its competitive capabilities to meet the demands of a changing environment. A principal proponent of this view has been Mintzberg (1979):

"Strategy is a mediating force between the organization and its environment: consistent patterns of the streams of organizational decisions to deal with the changing environment" (p.25).

- Fifth, strategy is a central vehicle for achieving sustainable competitive capabilities and advantages

Michael Porter has championed the quest for the competitive advantage as the central thrust in this dimension of the concept of strategy. In his first book (1980), he defined the framework of Five Competitive Forces for assessing the attractiveness of an industry and discussed generic strategies for effectively positioning a firm within that industry. In his second book (1985), he defined competitive strategy as:

"The search for a favourable competitive position in an industry, the fundamental arena in which competition occurs. Competitive strategy aims to establish a profitable and sustainable position against the forces that determine industry competition" (p.1).

In this book, Porter applied activity-based theory as a way to conceptualise the firm that would expose the underpinnings of competitive advantage and its sustainability. Competitive advantage introduces the concept of the value chain, a conceptual framework for thinking strategically about the activities involved in any business and assessing their relative *cost* and role in *differentiation*. It offers a way to go beyond broad or unidimensional characterization of competitive advantage; to become multidimensional, more than just ascribed competitive advantage to overall size or market share.

- Sixth, strategy as a logical system for differentiating managerial tasks at corporate, business and functional levels

The various hierarchical levels in the organization have quite different managerial responsibilities in terms of their contribution to defining the strategy of the firm. Andrews (1980) makes a clear distinction between the notions of strategy at the corporate, business and functional level:

"Corporate strategy defines the business in which a company will compete, preferably in a way that focuses resources to convert distinctive competence into competitive advantage" (p.18-19).

"Business strategy is the determination of how a company will compete in a given business and position itself among its competitors" (p. 18).

"The key assignment of the functional level is the develop the necessary competencies – in finance, administrative infrastructure, human resources, manufacturing, technology, procurement, logistics, distribution, marketing, sales, and services – needed to achieve and sustain competitive advantage" (p. 19-20).

Regardless of the structure adopted by a firm, three highly differentiated strategic concerns still remain: The first addresses the organization as whole (corporate strategy); the second is intrinsic to the business unit (business strategy); and the third involves the development of functional competences (functional strategy).

- Seventh, strategy as a definition of the economic and non-economic contribution the firm intends to make to its stakeholders

The notion of stakeholders has gained importance as a critical element of strategic concern in the past few years. *Stakeholders* is a term designating everybody who directly or indirectly receives the benefits or costs derived from the activities of the firm: shareholders, employees, managers, customers, suppliers, debt-holders, communities, government, and so forth.

Andrews (1980) in a very popular definition, reinforces the notion of strategy as a determinant of organizational purpose and explicitly notes the importance of stakeholders:

"Corporate strategy is the pattern of decisions in a company that determines and reveals its objectives, purposes, or goals, produces the principal policies and plans for achieving those goals, and defines the range of business is to pursue, the kind of economic and human organization it is or intends to be, and the nature of the economic and non-economic contribution it intends to make to its shareholders, employees, customers, and communities" (p.18).

An even greater emphasis is put in the importance of stakeholders in the definition of strategy given by Chaffee (1985):

"Strategy is defined as orienting "metaphors" or frames of reference that allow the organization and its environment to be understood by organizational stakeholders. On this basis, stakeholders are motivated to believe and to act in ways that are expected to produce favourable results for the organization" (p.93).

This dimension of the concept of strategy emphasizes the need to establish social contracts, perceived as a collection of cooperative agreements entered into by an individual with free will,

which will produce a process of social interchange in which perceptions will be affirmed, modified or replaced. Strategy is then the basis thrust and core theme that will enhance cooperative behaviour contributing toward organizational well-being.

In order to move towards a unified conceptualization of strategy, Hax and Majluf (1988) pointed out, strategy has to be seen as a multidimensional concept that integrates all the critical activities of the firm, providing it with a sense of unity, direction, and purpose, as well as facilitating the changes induced by its environment. Hax and Majluf skilfully identified a number of fundamental characteristics and dimensions of the nature of strategy in the business context and integrated the common grounds between the major schools of thoughts within the field of strategy. In fact, they combined them all into a single multidimensional definition of strategy, thus:

Strategy

- ***Is a coherent, unifying, and integrative pattern of decisions;***
- ***Determines and reveals the organizational purpose in terms of long-term objectives, action programs, and resource allocation priorities;***
- ***Selects the businesses the organization is in or is to be in;***
- ***Define the kind of economic and human organization the company is or intend to be;***
- ***Attempts to achieve a long-term sustainable advantage in each of its business by responding properly to the opportunities and threats in the firm's environment and strengths and weaknesses of the organization;***
- ***Engages all the hierarchical levels of the firm (corporate, business, functional); and***
- ***Defines the nature of the economic and non-economic contributions it intends to make to its stakeholders.***

(Hax and Majluf, 1988, p. 102)

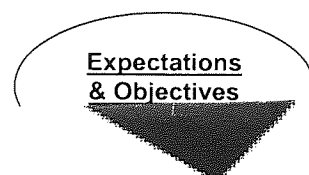
4. 2. 2. The Theoretical Foundations for Strategic Management

From the above multidimensional conceptualisation of strategy suggested by Hax and Majulf (1988), strategy becomes a fundamental conception of management decision-making through which an organization can assert its vital continuity while, at the same time, forcefully facilitating its adaptation to a changing environment. *The essence of strategic management*, either in the contents or in the processes, thus becomes the purposeful management of organization's goals and objectives, its environmental and organizational context, and to integrate them in a holistic way in achieving and sustaining satisfactory alignments for gaining competitive advantage.

In other words, argued by de Wit and Meyer (1998), the *essential issue* of strategic management is 'how can current, and potential, strengths and weaknesses of the organization be aligned with the current, and potential opportunities and threats in the environment, in a way that the firm will be able to achieve its 'goals' and 'objectives' in attaining competitive advantage?'

A conceptual framework (see Figure 4.1) provided by David Faulkner (1992, p.19) best illustrates this essence for defining and thinking about strategic management. *Strategy*, it is suggested, is a *function of management decision-making, either in its contents or in its processes, which seeks to integrate three essential factors: the environmental context* in which the business operates, *the organizational context* of resource and capability at its disposal for competing, and *the expectations and objectives* of various its stakeholders.

Figure 4.1 Management of strategy



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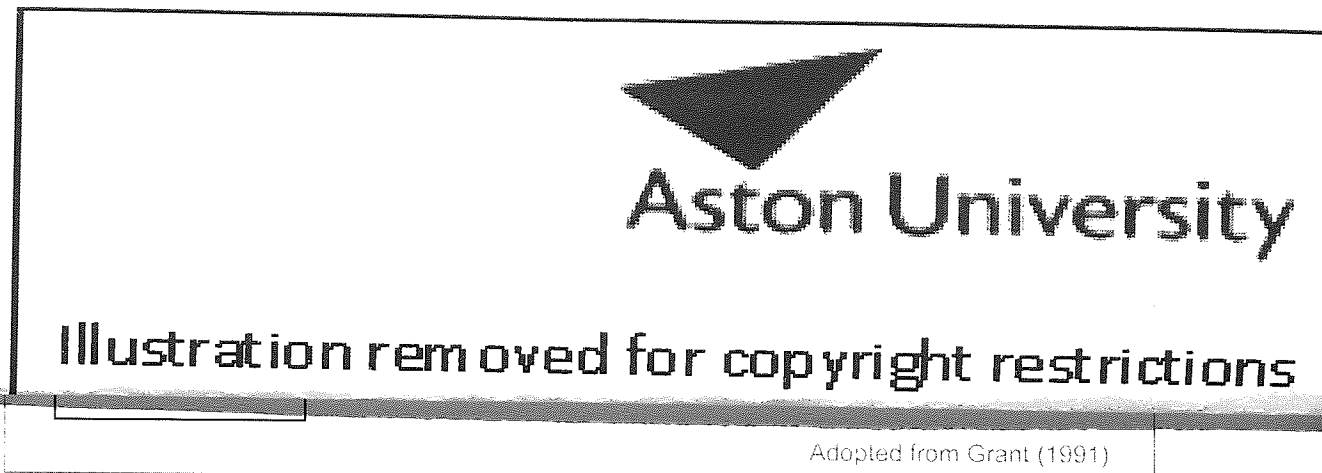
STRATEGY

Adopted from Faulkner (1992)

Grant (1991), in his book "*contemporary strategy analysis*", also views the essence of strategic management as forming and sustaining an active link between the firm and its environment. He provides a conceptual framework as the analytical foundations for strategic management (Figure 4.2). He also notes that the environmental context of the firm comprises the whole range of the economic, social, political, and technological factors that influence a firm's decision-making and

its performance. However, for the most strategic decision, the core of the firm's environmental context is its *industry*, which is defined by the firm's relationships with customers, competitors, and suppliers (1991, p.12).

Figure 4.2 The basic framework: strategy as a link between the firm and its environment



As noted at the outset of this chapter, virtually everyone writing on strategy agrees there is no one universal "best way" of strategic management neither in the its content nor in its process. In the business strategy literature, there is a startling variety of frameworks and approaches to strategic management. However, as suggested by Mintzberg (1990), Eisenhardt and Zbaracki (1992), and Bailey and Johnson (1993), in fact, there is common ground and general structure among all the different frameworks and approaches to strategic management. The language of the various models is very different but the underlying conception is similar and most of them are not incompatible. After all, as they suggested, these different frameworks and approaches are all specific means of making the essence of strategic management operational under given context. This common ground and general structure is best illustrated by Drucker's general idea behind the strategic management of business operations (see Figure 4.4).

Figure 4.3 General ideas behind strategic management

Environmental analysis to



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The various strategic management frameworks in the business strategy literature all share this general structure and serve these generic objectives but differ in detail, in the emphasis of their analysis. The difference of focus results from the development of the different frameworks at different times, in different circumstances and in response to different imperatives. They are specific cases for the general idea behind the strategic management. None serves adequately as a general solution to the strategic problem, but they all generate particular insights and have particular strengths and uses. The selection and application of the appropriate strategic management framework, or even the development of a new framework, can then be achieved on an informed basis of understanding about the frameworks and the context in which they are to be used.

However, a basic premise reviewed from the forgoing concerns the *inseparability* of the strategic management and its embedded context.

First, according to the essential thesis of social and organizational sciences reviewed in Chapter 2, meaning is derived from context. That is, we understand 'what' is going on, 'how' and 'why', by appreciating 'where' and 'when' it is happening. Observations are embedded and must be understood within a context. It is impossible to comprehend the difficulties encountered in studying *the multidimensional nature of strategic management* if one ignores the fact that the content of strategy and the process of making it and bringing it into reality are inseparable in any actual context setting. The set of circumstances both organizational and environmental under which the strategy *process* and the strategy *content* are determined is referred as *strategy context* (de Wit and Meyer, 1998, p. 6).

Second, each strategic problem situation is by its nature three dimensional, possessing *process*, *content*, and *context* characteristics, and only the understanding of all three dimensions will give the strategist real depth of comprehension. In particular, it must be acknowledged that the three dimensions interact (Pettigrew and Whipp, 1989). Therefore, in accordance with their views (Porter, 1980; Pettigrew, 1989; Mintzberg, 1990; Pettigrew and Whipp, 1989), it must to be emphasized that the *process*, *content*, and *context* are inseparable dimensions of strategic management.

4. 2. 3. The Configuration Perspective of Strategy Development

The above contextual thesis and three-dimensional view is best illustrated in Mintzberg (1990 and 1997)'s *configuration school* of strategy development research. Concepts of strategic management, as it suggests, are made operational via management practices of 'strategy development' for business operations at various levels of the organization, what we can define as the corporate, SBU, and functional levels. Content and process are both important aspects of effective strategy development practice. Strategy content describes a state of being. Strategy process is the way in which this state of being comes about over time. These are really two sides of the same coin: if an organization adopts states of being configured by contents of strategy, then the process of strategy becomes transformation bringing organization from one state to another. .

Most of the time, business operations can be described as being in stable state, where their characteristics are shaped by the strategy content matched to particular organizational and environmental operating context. However, as the environment changes, so does the organization's condition, normally incrementally, but occasionally in a dramatic shift. Thus, at some point, the synchronization between the operations system and its context breaks down. In order to re-establish the alignment, the strategy process acts to bring the operations system to a new state of being – a new strategy emerges which seeks to match characteristics of the system with new organizational and environmental context. The successive states of being and periods of transformation may order themselves over time into patterned sequences, which can be viewed as life cycles of business operations. In other words, transformation is an inevitable consequence of configuration. *There is a time for coherence and a time for change.* This best explains the rather curious characteristic of strategic management identified in the previous section that it asserts organization's vital continuity while, at the same time, forcefully facilitating adaptation to a changing environment. Strategy itself is not about change at all, but about continuity – whether as deliberate patterns of decisions or as emergent course of actions. The process of strategy is the purposeful management of change – whether as fully intended deliberate rational planning or as emergent incremental learning serving to realign organization with its environment in order to sustain the competitive advantage and continuity of itself.

Mintzberg (1990) went further suggesting that *the process of strategy development* could be one of conceptual designing or formal planning, systematic analysing or leadership visioning, cooperative learning or competitive politicking, focusing on individual cognition, collective socialization, or simple response to the force of the environment. But each must be found at its own time and in its own context. The resulting *strategy content* can take the form of plans or patterns, positions or perspectives, or else ploys, but again, each for its own time and match to its own context. There is no "one best way" to strategy development, neither in the content nor in the process, which is applicable for all time and all circumstances. From this *configuration perspective*, as pointed out by Mintzberg (1990), the effective set of content and process for

strategy development is contingent upon the specific context of organization's conditions (resources, capabilities, structure, power, and cultural systems), environmental forces and specific goals and objectives of the organization.

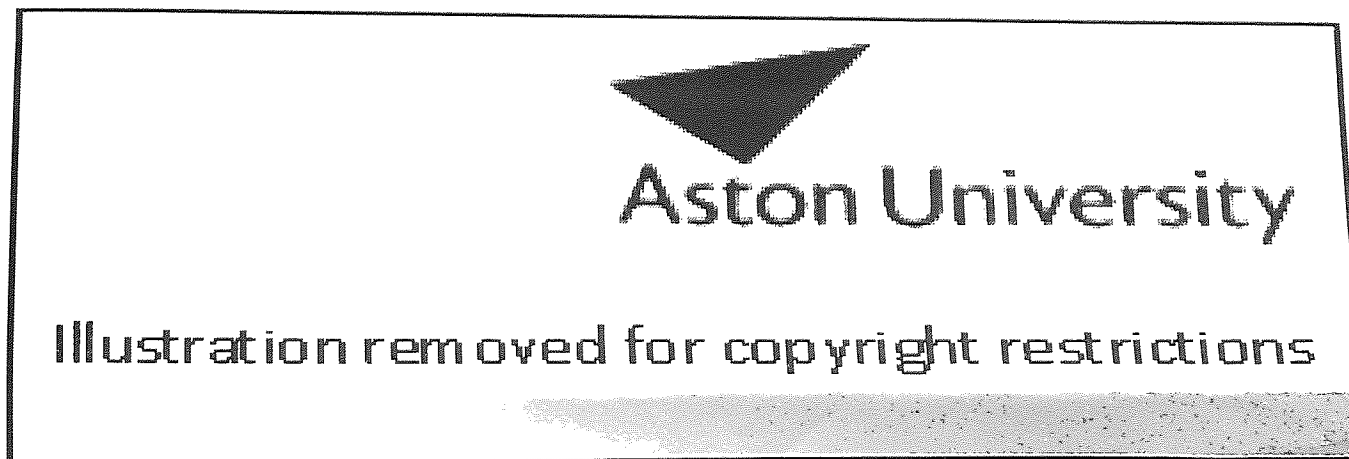
Those different theories and approaches proposed by leading scholars in the literature of strategy development, in fact, pointed out by Pettigrew and Whipp (1989), Mintzberg (1990) and de Wit and Meyer (1998), focused on different types of organizations and different episodes in their development; they have studied different phenomena and different organizational processes involved. For example, whereas Quinn (1980) interviewed executives about their thought processes (namely their intentions and perceptions), Miller (1983, 1986) tracked the recorded behaviours of organizations (namely their actions and outcomes). So the two might in fact have been describing two stages in the same *process of strategy* at different analysis level: strategists may learn incrementally and then drive strategic transformation of organization in revolutionary fashion. In other words, individuals is continuously learning and ongoing changing while new information occurs, but organization may bide it time until it figures out where it has to go, and then when a strategic window opens, it leaps to a new state of configuration. This indicates how important it is to appreciate and incorporate different approaches and schools of thought about strategy development as well as to combine them into an integrative multidimensional profile and theoretical perspective of the research.

4. 2. 4. Defining Theoretical Perspective of the Research

In the previous section, from the configuration perspective when unravelling the three dimensions of strategy development, the strategy process was defined as the way by which strategies come about. In fact, as Anderson et al. (1991) pointed out that it was the actual process of strategy development that established the alignment between organization and its environment, integrated the context and content of strategy, and created the strategy of the organization, and from time to time forcefully managed the strategic change and transformation to re-align them into a new state of configuration. After all, as they suggested, it was the actual process of strategy development that created the opportunity for strategic management of the organization.

In the process school of business strategy literature, the concept of strategic management, that an alignment and integration between the firm and its environment must be established and forcefully sustained for gaining competitive advantage, is widely regarded as the underlying conception for strategy process studies among scholars and practitioners (see Rumelt, 1980). Dating back to the late 1960s, Andrews (see Christensen, Andrews, et al., 1971) first applied this underlying conception to lay the conceptual foundation for the process model of strategy development in probably the most influential textbooks in the field - 'Business Policy: Text and Case' (see Figure 4.4).

Figure 4.4 Process Model of Strategy Development



of
Strategy

Adopted from Christensen, Andrews, et al. (1971)

However, in the above model of strategy process Andrews does not detail the organizational process needed to arrive at plans and to ensure their implementation and refinement. His work

focuses mainly on establishing analytical conception needed to conceive a strategy process for the organization that would best illustrate and operationalise the concept of strategic management established in the literature. But in fact, as mention at the outset of this chapter, it is a tribute to the soundness of this conceptual foundation for strategy process model that it indeed has spawned many of those following developments in the process school of business strategy literature.

Ever since, most literature in the process school advocates a rational planning perspective to the paradigm and organization of strategy process that mainly focuses on detailing the prescription on organizational processes *needed* in the strategy development practice. Wheelen and Hunger (1992) developed a very clear prescriptive model of strategy process, where decisions of a higher order, such as mission and strategy, are first taken and then flow to lower levels where they are translated into programs, budgets, and final actions. Despite their remark that feedback loops are possible, their model is basically linear (see Figure 4.5).

Figure 4.5 A Prescriptive Model for Strategy Process



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Feedback

Adopted from Wheelen & Hunger (1992)

While this rational planning perspective is excellent for prescriptions on how management should do in managing strategy process, it tends to focus unduly on measurable quantitative factors and to underemphasize the vital qualitative, power-behavioural and organizational processes actually involved (de Wit and Meyer, 1998). However, the popularity of this rational planning perspective in the literature does not prove that it is the "best way" - or even a realistic way - to operationalise the underlying conception of strategic management in the contemporary organizations. Environmental forces and organizational capabilities undoubtedly affect the performance of the firm but do not in themselves create strategy: people create strategy. After all, it is people manage, rather than "forces" or "facts" (Drucker, 1974).

By studying firms using an empirical and longitudinal design, researchers in the process school of business strategy have provided important insights on how cultural, political and cognitive factors so often influence and sometime determine the strategy and strategic success of the organization rather than the unitary effect of rational analytic processes. James Quinn pioneered such development in the business strategy literature. In "Logical Incrementalism", Quinn (1980) does not reject the fundamental conception of rational planning as the building block for managing strategy process in the organization, but he argues that it is ONLY one of the "building blocks" actually involved. According to Quinn, writers who exalt the virtues of rational planning perspective make faulty assumptions about the "knowability" of the environment ("cognitive limits") and the rationality and controllability of organizations ("process limits"). After all, it is the faulty assumption about the limits of people both as the subject and object of management in operationalising the underlying conception of strategic management. In the same vein, Chaffee (1985) speaks of the need for an adaptive model of strategy development, while Mintzberg (1990) speaks of the learning school of thought. While the planning and incrementalist perspectives differ on many accounts, they both share the assumption that strategy process can be accounted for by logical, rational processes either through the planning mode or through the adaptive, incremental mode. In either event the manager is a proactive strategy formulator consciously seeking to understand a complex environment, so as to establish casual patterns and develop strategy by configuring organizational resources to meet environmental needs.

Furthermore, there is a different theoretical perspective in the incrementalist vein, however, that does not assume rational managers and views strategy as "the product of the political, cognitive, and cultural fabric of the organization." This school of thought, which Quinn refers to in his article as power-behaviour, but also called interpretative (Chaffee, 1985), and political and cultural (Bailey and Johnson, 1993), is named the "organizational action view" of the strategy processes by Johnson (1988). Johnson agrees with Quinn that incrementalism is more realizable than rational planning in operationalising the underlying conception of strategic management, but since organizations (so as most of environments) are not mechanical systems, but social systems, as he points out, that if managerial processes which give rise to the development of strategy are examined and understood in cultural, political, and cognitive terms then it becomes clear that the strategic complexity that managers face cannot readily be analysed objectively and rationally within the managerial task and context. Managers have a set of core beliefs and assumptions, which are specific and relevant to the organization in which they work and which are learned over time. Whilst individual managers may hold quite varying sets of beliefs about many different aspects of that organizational world, there is likely to exist at some level a core set of beliefs and assumptions held commonly by the managers - management paradigm (Johnson, 1988). Weick (1987) argues that it is this core set of beliefs and assumptions that managers commonly hold, a cognitive map or managerial paradigm that provides a view of the world, helps interpret the changes in organizational capabilities and environmental forces, and provide appropriate responses in aligning them in a holistic way through the actual process of strategy.

Arguably the above three theoretical perspectives in the process school of business strategy literature more generally embrace two broad thrusts about views on the management of strategy process. One way to organize these various explanations of strategy process, as Hax and Majluf (1988) suggest, is to use Mintzberg and Waters' (1985) definition of deliberate and emergent strategy (see Figure 4.6).

Figure 4.6 Forms of Strategy



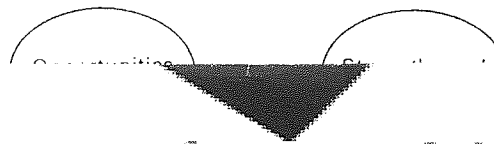
Adopted from Mintzberg & Waters (1985)

Intended strategies are the patterns of decisions that organizations plan to execute, while realized strategies are the patterns of action that have been accomplished. As Figure 4.6 indicates, one would expect that intended strategy would lead to 'realized strategy'. Where realized strategies were proactively intended by logical, rational processes either through the planning mode or through the adaptive, incremental mode, Mintzberg and Waters speak of deliberate strategy. However, they argue that realized strategies can also come about as the emergent product of political, programmatic, cognitive, or symbolic aspects of management, which they label emergent strategy. As Mintzberg and Water (1985) suggest that this distinction between deliberate and emergent strategy goes to the very heart of those key issues and debates on how strategy process should be managed in the organization. In fact, the concepts of deliberate and emergent strategy, especially in their interplay, as suggested by Hax and Majluf (1988, p.107), form the basis for an Analytic Typology to interpret, structure and synthesize those various dimensions and explanations of the multifaceted and situational nature of strategy process.

Along this typology, from the configuration perspective reviewed earlier (Pettigrew and Whipp, 1989 and Mintzberg, 1990), the process of strategy development is shaped and configured by both deliberate and emergent forces encapsulated within the management paradigm of the organization. Of special note, after Mintzberg (1990), for the effective management of strategy process it is not only the deliberate or emergent process that is our concern, but the actual integrative paradigm by which the deliberate and emergent processes act together under the context embedded and result in a realized and successful strategy.

An area of growing importance and school of studies in the business strategy literature has been the development of configuration model (taxonomies and typologies) to explore and delineate the integrative paradigm (deliberate/emergent) of strategy development in the actual context of contemporary organization, and to explain the multidimensional and situational nature of the strategy process, which is termed by Huff and Reger (1987) the integrative school of strategy process research (eg Chaffee, 1985; Hickson et al, 1986; Johnson, 1988; Schwenk, 1988; Mintzberg, 1990; Eisenhardt and Zbaracki, 1992; Bailey and Johnson, 1993; Hart and Banbury, 1994; de Wit and Meyer, 1998). Perhaps the most precise rendition of this integrative school of strategy process research is provided by Johnson (1988)'s work of "Strategy Development Process - an integrative perspective" (see Figure 4.7).

Figure 4.7 Strategy Development Process - an integrative perspective



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Adopted from Johnson (1985)

Four major theoretical arguments of integrative school are summarized as following:

First, as we can see, this integrative perspective of strategy development is firmly building on the conceptual foundation of strategy process laid by Andrews (see Figure 4.6). Also it regards the fundamental conception of rational planning as the building block for managing strategy process in the organization, but views it as only one of the "building blocks" of how strategy is actually developed in the contemporary organization and reconciles them into a multidimensional profile of strategy process. However, rather than making faulty assumptions about the "knowability" of the environment and the rationality and controllability of organizations as the rational planning perspective, the integrative perspective recognizes the "cognitive limits" of the environment and the "process limits" of the organization in operationalising the concepts of strategic management and focuses on the exploring and delineating the empirical paradigms and organizations of strategy process in the actual context of contemporary organization.

Second, the empirical evidence from the above studies in the integrative school shows that the strategic decisions arise through the application of managerial experience as a filter of external and internal stimuli, within a politicised social setting. The "organizational processes" that gives rise to strategy is, then, most likely to be shaped and related to the 'taken for granted' assumptions, beliefs and values that are encapsulated within the idea of managerial experience and organizational culture. Managers have a set of core beliefs and assumptions, which are specific and relevant to the organization in which they work and which are learned over time. It is likely to evolve over time; might embrace perspectives about the nature of the organizational and environmental context, the managerial style in the organization, the nature of its leaders, managerial style and the operational routines seen as important to ensure the success of the organization. It is this paradigm which, in many organization studied, creates a relatively homogeneous approach to the interpretation of the strategic complexity that the organization faces. The various and often confusing signals that the organization faces are made sense of, and filtered, in terms of this paradigm. Moreover, since it evolves over time and is reinforced through the history and perhaps the success of the organization, it also provides a repertoire of actions and responses to interpretations of signals which are experienced by managers and seen by them as demonstrably relevant. It is, at one and the same time, a device for interpretation and a formula for action. The likelihood of this paradigm dominating the development of strategy and giving rise to the multifaceted and situational nature of strategy process that is context-specific to the organization becomes clearer when the wider cultural and political context in which it embedded is considered.

Third, as pointed out by Johnson (1988), Mintzberg (1990), Eisenhardt and Zbaracki (1992) and Bailey and Johnson (1993), it's precisely the exploring, delineating, and explaining of this paradigm of strategy development that is the essential concern and central focus of the integrative school of strategy process research. This is demonstrably in line with the essential thesis of social and organizational sciences that came crossed earlier in Chapter 2. As illustrated by Laing (1967, p.53-64), who points out the error of blindly following the approach of the natural science in the study of the social world, 'The error fundamentally is the failure to realise that there is an ontological discontinuity between human beings and it-beings... Persons are distinguished from things in that persons experience the world, whereas things behave in the world.' Therefore, the social world cannot be understood in terms of causal relationships that do not take account of the situation that human actions are based upon the actor's interpretation of events.

From the perspective of manufacturing strategy research, integrative school's essential focus on the paradigm of strategy development also fits in nicely with the critical need for the development on current process models revealed in previous chapter. As Anderson et al. (1991, p.89) suggest that there is much less emphasis in extant manufacturing strategy process research on the actual organizational processes involved and the empirical "synthesis" linking mechanism required in developing an effective manufacturing strategy. What seems critical, pointed out by them is to develop further our understanding of the multidimensional conceptualisation of the manufacturing strategy process. Also as Swink and Way (1995) suggest that the essential challenge which faces

manufacturing strategy researchers is to identify and characterize the environmental and organizational contingencies in the paradigm of strategy development.

Fourth, the integrative school does not merely focus on the manner by which strategies are initially formulated. It views the integral and actual strategy process, by including processes of strategic thinking, strategic decision-making, and strategic change as the major constructs of studies which will be discussed in detail later. It strives to strike a balance between the empirical description of how most firms actually go about developing strategy (emergent explanation) and the analytical prescription of how they should improve their current process (deliberate explanation). After all, as Johnson (1988) argued that from the integrative perspective we are interested in both the 'knowing' and the 'doing' of strategy development.

In short, theoretical perspective of the research has been defined as the integrative school of configuration research on the paradigm of strategy development.

4. 3. Theoretical Design of the Research

Following the 'theoretical perspective' defined in previous section, here the author will discuss and present 'theoretical design' of the research, namely the main things to be studied within the scope of the research.

Given the critical limitations identified in the existing paradigm of manufacturing strategy development from a theoretical perspective (see chapter 3), the author follows the suggestion from many others (Adam and Swamidass, 1989; Ward et al., 1990; Minor et al., 1994; Amundson, 1998) to integrate concepts, constructs, and essential facets of investigation from the business strategy literature to study the strategy development practice for manufacturing.

The 'content' of manufacturing strategy has been subject to much more conceptual development in the literature than process and context issues. Although there are unitary limitations from a theoretical perspective regarding the managerial perceptions, the existing content model has clearly defined in operational/measurable terms the concept and critical elements of manufacturing strategy content. There is general agreement, as discussed in the literature, on the conceptions and constructs defined. Based on this content model in the literature, an analytical framework has been devised by the author as the template of analysis for organising the empirical investigations on manufacturing strategy content (see Chapter 3 section 3.6.2 and Figure 3.3).

Therefore, the focus of discussion here will be on formulating analytical frameworks for the 'process' and 'context' of manufacturing strategy development

The author applied the typology of deliberate and emergent strategy to provide an analytic review on prior developments in the integrative school of strategy process research in the business strategy literature. The objective is to formulate framework and template of analysis on:

1. Major constructs of strategy development process
2. Key issues of study central to the paradigm of each major construct of strategy development process
3. Essential facets of investigation from previous empirical studies on the above key issues
4. Categorizing the empirical process patterns of strategy development explored
5. Charactering the empirical process paradigm of strategy development explored
6. Analytical framework for delineating the overall strategic context of manufacturing
7. Performance measurements applied in the research

4. 3. 1. Analytical Framework for Investigating the Process of Manufacturing Strategy

➤ Major Constructs of Strategy Process Research

In fact, the integrative school of strategy process research in the business strategy literature, as defined by Bower and Doz (1979, p. 1519), views strategy as the outcome of three essentially distinguishable and intrinsically related processes contributing to the strategy development:

1. The cognitive and reasoning processes of individuals on which information and understanding of the context of strategy are based – the process of strategic thinking;
2. The social and organizational processes by which perceptions are channelled and commitments developed – the process of strategic decision-making; and
3. The transformational processes by which the alignment between organization and its environment is established and sustained – the process of strategic change.

These three processes, as Bower and Doz (1979) suggest, are the major constructs in exploring, delineating, and explaining strategy development process. This notion, as suggested by Huff and Reger (1988), has been one of the underlying propositions of integrative school of strategy process research, and well illustrated by de Wit and Meyer (1998) in their book, "Strategy Synthesis – Resolving Strategy Paradoxes to Create Competitive Advantage":

"Strategic thinking, strategic decision-making, and strategic change – don not constitute entirely separate subjects. Let it be clear that they are not phases, stages or elements of the strategy process, that can be understood in isolation. They are different aspects of the strategy process, that are strongly linked and partially overlapping. They have been selected as major constructs here because they are the sets of key issues on which there has been significant research effort and variety of explanations in the field of business strategy."

(p. 8-9)

Traditionally, as most of the literature in manufacturing strategy, strategy process has been portrayed and studied as a basically linear progression through a number of distinct steps. Usually the constructs of study are made by the strategy analysis stage, the strategy formulation stage and the strategy implementation stage. In the analysis stage, strategists identify the opportunities and threats in the environment, as well as the strengths and weaknesses of the organization. Next, in the formulation stage, strategists determine which strategic options are available to them, evaluate each and choose one. Finally, in the implementation stage the selected strategic option is translated into a number of concrete activities that are then carried out. It commonly presumed that this process is not only linear, but also largely rational – strategists identify, determine, evaluate, choose, translate and carry out, based on rigorous logic and extensive knowledge of all factors. Furthermore, the assumption is frequently made that the strategy process is comprehensive – strategy is made for entire organization and everything can be radically change all at once.

All these beliefs have been challenged while the multifaceted and situational nature of strategy process is furthering explored and reported in the business strategy literature. For instance, many authors have criticized the overriding emphasis on analytic rationality in strategy process as it prevailed in the manufacturing strategy literature. Some writers have been argued that the true nature of strategic thinking is intuitive and creative as well as rational and analytic (Miller and Hayslip, 1989; Anderson et al. 1991, and Stalk et al. 1992). In their opinion, strategizing is about perceiving strengths and weaknesses, envisioning opportunities and threats, and creating the future, for which imagination and judgement are equally important as analysis and logic.

The division of the strategy process into a number of sequential phases has also drawn heavy criticism from authors who believe that in reality no such identifiable stages exist. They dismiss the linear analysis – formulation – implementation distinction as an unwarranted simplification, arguing that the strategy process is more messy, with analysis, formulation and implementation activities going on all the time, thoroughly intertwined with one another that form the actual processes of strategic decision-making. As Huff and Reger (1987) suggest in their review of strategy process that by studying firms using a longitudinal design, researchers have begun to understand how rational planning and incremental political actions combine to influence strategy process. Mintzberg and Waters (1985) coined the phase “**strategy formation**” as opposed to formulation to describe these intertwined and interactive strategic decision-making processes. These two points had also been revealed through the pre-research investigation to be important in the context of China’s SOEs (see Chapter 3, section 3.3.2 - 3.3.3).

The third major assumption of the traditional view, comprehensiveness, has also been challenged. Many authors from the integrative school have pointed out that it is unrealistic to suppose that a company can be boldly redesigned. They argue that it is terribly difficult to orchestrate an overarching strategy for the entire organization, especially when this entails a significant departure from the current courses of action. It is virtually impossible to get various aspects of an organization all lined up to go through a change at the same time. In practice, as discovered in pre-research investigation at Yanshan, different aspects of an organization will be under different pressures, on different timetables and have different abilities to change, leading to a differentiated approach to strategic change. Moreover, the rate and direction of change will be seriously limited by the cultural, political and cognitive inheritance of the firm.

Rather than assume a unitary rational and linear explanation of the strategy process as revealed in the extant literature of manufacturing strategy, it is recognized in this research project that the nature of strategy development process is multidimensional and situational as suggested in business strategy literature. And the research takes the processes of strategic thinking, strategic decision-making, and strategic change as the major constructs of empirical studies in exploring, delineating, and categorizing the empirical paradigm of manufacturing strategy development in the actual context of China’s SOEs.

➤ **Key Issues of Study Central to Each of the Major Constructs**

In this section, *key issues of study* central to each of the major constructs of strategy development process will be first identified through a close exam on those critical concerns regarded by the previous studies in the literature. Upon this, the author will then apply the typology of 'deliberate and emergent' strategy to provide an analytical review to interpret, structure and synthesize those various explanations argued in the literature regarding those key issues identified.

(i) Strategic Thinking

This major construct of strategy process research deals with the mode of thinking and behavioural action employed by management when confronted with strategic problems.

Two key issues, as suggested by de Wit and Meyer (1998, p. 56-57), are central to the study of strategic thinking. They are:

1. How are strategic problems identified and conceptualised?
2. How are potential solutions generated, evaluated, and decided on?

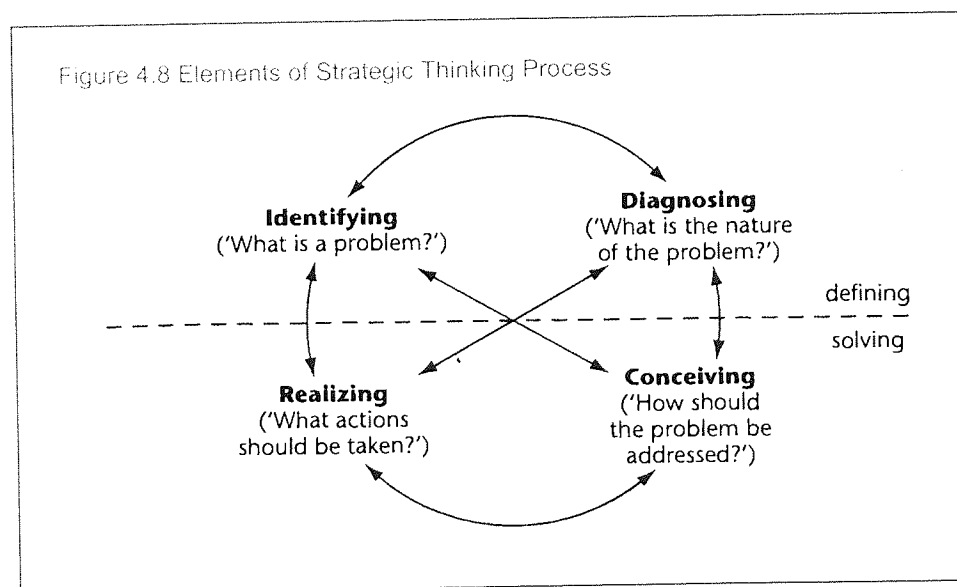
At the deliberate extreme of the typology, strategists adopting the rational linear thinking perspective argue that strategic thinking is predominantly a 'rational activity' (Andrew, 1987). To deal with strategic problems the strategist first consciously and thoroughly analyse the problem situation. Data must be gathered on all developments internal and external to the organization, and this data must be processed to: first, pinpoint the opportunities and threats in the organization's environment; second, appraise the organization itself to uncover its strengths and weakness.

Once the problem has been defined, a number of alternative strategies can be identified by matching external opportunities to internal strengths. Then strategic options must be extensively "screened" by evaluating them on a number of criteria, such as consistency, consonance, advantage, feasibility, potential return and risks. The best strategy can be selected by comparing the scores of all options and determining the level of risk the strategist is willing to take. Then chosen strategy can subsequently be implemented.

This type of intellectual effort required well-developed analytical skills and application of appropriate analytical and systematic techniques. Strategists must be able to rigorously, consistently and objectively comb through huge amount of data, interpreting and combining findings to arrive at a complete picture of the current problem situation. Possible solutions require critical appraisal and all possible contingencies must be logically thought through. While depicted here as a purely linear process of analysis, evaluation and choice, proponents of the rational thinking perspective note that in reality strategists often have to backtrack and redo some of these steps, as new information becomes available or chosen strategies do not work out.

At the emergent extreme of the typology, strategists adopting the incremental creative thinking perspective argue that strategists should not get too caught up in rational approaches to strategic thinking, but should nurture creativity as their primary cognitive assets. The incremental thinking perspective is based on the assumption that strategic problems are organized complexities. It is believed that strategic problems cannot be easily and objectively defined, but that they are open to interpretation from a limitless variety of angles. The same is true for the possible solutions – there is no fixed set of problem solutions from which the strategist must select the best one. Problem definitions are highly subjective and there are no fixed solution sets. It is therefore impossible to identify the problem and calculate an optimal solution. Opportunities and threats do not exist, waiting for the analyst to discover them. Neither can strengths and weaknesses be objectively determined – a strategist can employ a company characteristic as strength, but can also turn a unique company quality into weakness by a lack of vision. Hence, doing a SWOT analysis actually has little to do with logical analysis, but in reality is nothing less than a creative interpretation of a problem situation. Defining and solving strategic problems, it is believed, is fundamentally a creative activity. In short, at the emergent extreme, advocates of the incremental creative perspective argue that the essence of strategic thinking is the ability to creatively challenge 'the tyranny of the given' (Kao, 1996) and to generate new and unique ways of understanding and doing things.

Most strategists, whether of rational linear or incremental creative inclination, agree that reasoning about strategic problems can be decomposed into four broad categories of mental activities (see Figure 4.8). What strategists do not agree on is how each activity is carried out and in what order.



From the rational thinking perspective, it is logical to start by identifying problems and then move from diagnosing to conceiving solutions and realizing them (clockwise movement in Figure 4.15.). In general, adherents of the rational thinking perspective believe that identifying strategic problems requires extensive external and internal scanning, thorough sifting of incoming information, and leave selecting of priority issues. In the next mental phase, the major strategic

problems that have been recognized are diagnosed by gathering more detailed data and further analysing and refining this information. Once the problem has been defined, a strategy can be formulated by evaluating the available options and deciding which solution is the best. In the final phase of realization, the strategist must ensure execution of the proposed solution by consciously planning and controlling implementation activities.

Proponents of the incremental creative thinking perspective do not believe that strategists reason in this linear fashion. They do not accept that the four categories of mental activities are phases. In their view, reasoning is usually far more messy, with identifying, diagnosing, conceiving, and realizing intermingled with one another and often going on at the same time. The more creative, the less linear are the thought processes. In the creative incremental view, identifying strategic problems is not about recognizing, but interpreting – by looking at the world from a particular angle, strategists see and value particular strength, weakness, opportunities and threats. Likewise, diagnosing strategic problems is not a straightforward analytical process. Reflecting on strategic problems may involve explicit analysis, but also intuition – understanding problems through unconscious and synthetic reasoning. Conceiving strategic solutions is equally messy and creative according to supporters of the generative perspective. Solutions are not lying around, waiting to be discovered, but are envisioned – strategists imagine how things could be done. Such idea generation may involve reasoning by analogy or metaphor, brainstorming, or pure fantasizing. Finally, it is emphasized that realization-oriented thinking does not come last, as straightforward implementation. Acting does not wait for a problem to be precisely defined and for a solution to be fully conceived. Often, to really understand a problem, people must first act – they must have experience with a problem and know that the current strategy will not be able to overcome the problem. To generate a solution it is often also necessary to test certain assumptions in practice and to experiment.

(ii) Strategic Decision-making

This major construct of strategy process research deals with the decision-making processes involved in the organization when confronted with strategic problems.

At the deliberate extreme of the typology, strategists adopting a rational planning perspective to strategic decision-making argue for the need of explicit strategies with forward-looking time implications through formal-analytical decision-making processes.

At the emergent extreme, strategists adopting an organizational action perspective to strategic decision-making argue for emergent strategies revealed from pattern of past actions of the organization through power-behavioural processes of decision-making.

The dispute between two extremes can be greatly clarified by distinguishing between three major issues on which the parties disagree (Hax and Majluf, 1988, p.102-107; also see de Wit and Meyer, 1998, p.104-109).

1. First, how explicit strategy should be communicated internally within the organization and externally to related constituencies.

Planning perspective argues that explicit strategy are needed to give organizations direction, without articulated strategy, incorporating objectives, organizations would be adrift. Incrementalists counter that direction-setting strategy can lead single-minded behaviour. Explicit strategy, they argue, work as blinkers, blocking out peripheral vision, keeping organizations sharply, yet myopically focused on one course of action (Pascale, 1984). Thus, articulated strategy limit organizations' ability to open to new opportunities and threats as these unfold and to derive from a set course as the organization interacts with its environment and learns.

Planning perspective argues that early commitment to a course of action is highly beneficial. By setting objectives and drawing up a plan to accomplish these, organizations can invest resources, train people, build up production capacity and take a clear position within their environment. Explicit strategy allows organizations to mobilize themselves and to dare to take actions that are difficult to reverse and have a long payback period (Ghemawat, 1991). Incrementalists, however, point out that articulating strategy indeed encourage strategists to take irreversible actions, locking the organization into a preset course of action (Evans, 1991). Therefore, inhibit organization's ability to adapt to changing circumstances.

Explicit strategy, as planning perspective argues, also has the benefit of coordinating all strategic initiatives within an organization into a single cohesive pattern. An organization-wide master plan can ensure that differences of opinion are ironed out and one consistent course of action followed throughout the entire organization, avoiding overlapping conflicting and contradictory behaviour. Yet, according to incrementalists, master plans usually lead to the squashing of initiative, either purposely or inadvertently. Coordination usually means centralization and unification, leaving little room for autonomous action by entrepreneurs within the organization (Burgelman, 1983). Bring together all strategic action into one grand scheme, does not encourage an internal market for ideas, where managers pursue contrarian initiatives and try to sell these to the rest of the organization.

Planners point out that plans also facilitate optimal resource allocation. Drawing up a plan disciplines strategists to explicitly consider all available information and consciously evaluate all available options. This allows strategists to choose the optimal course of action, before committing resources. Documented plans also permit corporate-level strategists to compare the courses of action proposed by their various business units and to allocate scarce resources to the most promising initiatives. Incrementalists counter that plans place a disproportionate emphasis on thinking over action. Enormous amounts of time and effort are put into analyses, paperwork, meetings and presentations, trying to arrive at the optimal plan. Often the result is that producing

a plan develops into an end in itself. Action is seen merely as operationalizing the plan, instead of as the primary input into further strategy development.

For planning perspective, plans are means for programming all organization activities in advance. Having detailed plans allows organizations to be run with the clockwork precision, reliability and efficiency of a machine. Incrementalists, however, frown on planner's worship of top-down control. According to incrementalists, using plans to pre-program all activities within an organization grossly overestimates the extent to which an organization can be run like a machine. For adaptation, experimentation and learning to take place and for new ideas to emerge from within the organization, a certain measure of chaos might actually be beneficial.

2. Whether the process of strategic decision-making should be formalized

The advantage of formalization, according to advocates of the planning perspective, is that it structures and disciplines the strategic decision-making process. Formalization facilitates tighter organization, unambiguous responsibilities, clearer accountability and stricter review of performance. A formal planning and decision-making system forces managers to comply with a planned approach to strategy development. It also gives top management more control over the organization, as all major activities must be in approved plans and implementation of plans is checked. However, incrementalists challenge the value of such extensive procedures. In their view, formal planning systems are attempts to use bureaucratic means to make strategic decisions. Formalization strongly over-emphasizes those aspects, which can be neatly organized such as meetings, writing reports, giving presentations, allocating resources and reviewing progress, while marginalizing essential strategy-making activities that are difficult to capture in procedures. Important aspects such as creating new insights, learning, innovation, building political support and entrepreneurship are side-line or crushed by rote bureaucratic mechanisms used to produce strategy. Moreover, planning bureaucracies, once established, come to live a life of their own, creating rules, regulations, procedures, checks, paperwork, schedules, deadlines, and double-checks, making the system inflexible, unresponsive, ineffective and demotivating.

Planning perspective believes in formalized decision-making process that relies heavily on analytical tools and methodologies to help managers to reach a better quality of strategic thinking. Strategic decision-making is regarded as a formal and disciplined process leading to a well-defined organization-wide effort to specify completely corporate, business, and functional strategy. Those favouring this approach tend to advocate the use of formal planning systems, management control, and consistent reward mechanisms to increase the quality of strategic decision-making (Ansoff, 1984; Yavitz and Newman, 1982; Porter, 1980, 1985). However, incrementalist rests on the behavioural theory of the firm and espouses a power-behavioural approach to strategy process. This school emphasizes multiple goal structures of organizations, the policy of strategic decisions, executive bargaining and negotiation, the role of coalitions in strategic management, and the practice of "muddling through" (Cyert and March, 1963; Lindbloom, 1959; Simon, 1976; Wrapp, 1984).

These two schools of thought have made significant contributions in increasing our understanding of the central issues regarding strategic decision-making processes in the organization. However, neither the formal-analytical planning nor the power-behavioural paradigms adequately explain the nature of strategy processes operate in the actual context of the organization. These taxonomies have been useful in focusing academic research work but neither serves as a normative or descriptive model. To get the best out of strategic decision-making, formal analytic thinking should be combined with the behavioural aspects of management. Quinn (1980), who has undertaken extensive field research on actual strategic change processes in major corporations, asserts that:

"Effective executives artfully blend formal analysis, behavioural techniques, and power politics to bring cohesive step-by-step movements towards ends, which initially are broadly conceived, but which are then constantly refined and reshaped as new information appears" (p. 3)

3. The time implications of strategic decision-making

Another dimension of controversy between planning and incremental perspective on strategic decision-making process is its time implications. From the planning perspective strategists view strategic decision-making exclusively as shaping the future direction of the firm; thus, the strategy of the firm becomes the collection of objectives and action programmes oriented toward the future of the organization. This school of thought is patently clear in the definition provided by Newman and Logan (1971):

"Strategies are forward-looking plan that anticipate change and initiate actions to take advantage of opportunities that are integrated into concept or mission of the company" (p. 7).

Alternatively, on the incremental extreme strategic decision-making is viewed as patterns of action emerging from the past decisions of the firm. A leading proponent of this school of thought is Mintzberg. Mintzberg and Water (1985) define strategy as " a pattern in a stream of decisions."

"This definition was developed to operationalize the concept of strategy, namely to provide a tangible basis on which to conduct research into how it forms in organizations. Streams of behaviour could be isolated and strategies identified as patterns or consistencies in such streams. The origins of these strategies could then be investigated, with particular attention paid to exploring the relationship between leadership plans and intentions, and what the organization actually did" (p. 257).

This dimension of controversy, as mentioned earlier, is one of the central issues of strategy making. Thousands of decisions are made each day in large and complex organizations. The only way to make them consistent is to establish some sense of permanent strategic direction to provide a framework within which those decisions can be made.

Nonetheless, interpreting strategy too rigidly as a pattern revealed in a past stream of decisions might lead to an inability to shape new directions. In a strict sense, strategy could only become known and explicit after the fact, when, from a historical perspective, it could be deciphered from the continuum of past events. For a practicing manager, this notion of strategy is clearly unacceptable. In deed, strategy is most important in dealing with intended change. Strategy should be formed in cognisance of the past heritage of the firm but, at the same time, be forward looking. Consequently, strategy making becomes a deliberate balance between learning from the past and shaping new courses of action to lead the organization toward a future state, which might include a substantial departure from its past conduct.

(iii) Strategic Change

For strategists either at the deliberate or at the emergent extreme of the typology, it is not an issues of whether organization must change, but of what manner they must change. This major construct of strategy process research deals with the 'manner of change' in the organization when confronted with strategic problems.

As the author revealed from the prior research on strategic change in the literature and also noted by Mintzberg (1997), one of the key issues in strategic change studies is central to the continuity of change.

At the deliberate extreme of the typology, strategists adopting a revolution perspective of discontinuous change argue that strategic change should be deliberately conceived, planned, programmed, and carried out in dramatic revolutionary manner as quantum leap bring organization to a new configuration of alignment with its internal and external context. Advocates of the discontinuous change perspective, therefore, argue that the strategic change should be managed by a top-down approach with strong leadership and comprehensive programming. Nowhere is this more evident than in the Business Process Reengineering (BPR) phenomenon, which involves top-down comprehensive programming for all aspects of the value chain to change at once (Grover and Malhotra, 1997).

Perhaps the most popular case in this top-down school of change is the approach stimulated by changes at General Electric under the leadership of Jack Welch. Tichy and Sherman, (1993) have described these as a "three-act drama": awakening, envisioning, and re-architecting. Kotter (1995, p.35) argues that:

“Change, by definition, requires creating a new system; which in turn always demands strong leadership at the top.”

At the emergent extreme of the typology, strategists adopting an evolution perspective of continuous change argue that transformation of the organization is far more of a bottom-up process, in which gradual and incremental changes taken within the pockets of the organization

drive the overall change process. Change to the advocates of continuous incremental perspective is an exploratory journey rather than a planned or driven one. Yet if it works, it can end up being significantly strategic. Nowhere is this more evident than in the concept what Imai (1986) termed "Kaizen".

Imai (1986) suggests that for successful transformation of the organization:

First, all employees within the firm should be committed to 'continuously improve'. Everyone within the organization should be driven by constructive dissatisfaction with the status quo. This attitude, that things can always be done better, reflects a rejection of stability and the acceptance of bounded instability – everything is open to change.

Second, everyone in the firm must be motivated to 'continuously learn'. People within the organization must constantly update their knowledge-base, which not only means acquiring new information, but also challenging accepted company wisdom.

Third, everyone in the firm must be motivated to 'continuously adapt'. Constant adjustment to external change and fluid internal realignment should be pursued. Strategists should strive to create flexible structures and systems, to encourage an open and tolerant corporate culture, and to provide sufficient job and career security for employees to accept other forms of ambiguity and uncertainty.

Together these three spirits of "Kaizen" are the essential characteristics of an evolutionary organization – continuous improvement, learning and adaptation. As Imai (1986) stressed out that the essence of "Kaizen" means ongoing improvement including everyone, including both managers and workers.

➤ **Defining Essential Facets of Investigation for Studying Manufacturing Strategy Process**

After the proceeding analytic review and discussion on those key issues regarded by the literature on each of the major constructs of strategy process, as White and Mitchell (1976) suggest, based on such understanding one should be able to reveal the essential process attributes or, more specifically, *facets of investigation*, from previous empirical studies done on the above key issues.

- Investigation Facet 1, Managerial Leadership

This facet of investigation is defined in operational/measurable terms by Westly and Mintzberg (1989) and Nanchman and Shrivastava (1989). Managerial leadership, as they suggested, deals with the extent to which management takes a defined and active role in the process of strategy development.

For the research, four central questions will be investigated regarding managerial leadership in the manufacturing strategy development process.

1. **The role of corporate staff in the process of manufacturing strategy development**

2. **The role of top-management in the process of manufacturing strategy development**

3. **The role of the manufacturing executive in the process of manufacturing strategy development**

4. **The role of the manufacturing executive played in the business strategy process**

As Westly and Mintzberg (1989) suggest that the role of managerial leadership in strategy process can be delineated on a generic continuum of spanning:

1. None - no substantive involvement.
2. Facilitator - an involvement whereby the executive takes leadership in facilitating a process in which he or she, along with immediate reporting managers, define the strategy.
3. Mediator - an involvement whereby the executive collects input from immediate reporting managers and then formulates a strategy.
4. Formulator - an involvement in which the executive defines the strategy then confers with various reporting managers.
5. Mandator - an involvement in which the executive defines and mandates strategy, leaving only tactical planning to reporting managers.

As Anderson et al. (1991) suggest that the role of manufacturing executive in the business strategy process can be delineated along a continuum of involvement:

1. None - no involvement
2. After the fact - manufacturing capabilities are taken into account, yet for all practical purposes the business strategy is developed, then manufacturing executive develops a tactical plan to support the strategy.
3. Passive - manufacturing is a participant to the extent that manufacturing executive is called upon to express the feasibility of manufacturing being able to support the business strategy.
4. Active- manufacturing is an active participant which helps define the business strategy by bringing to the strategic planning process the various constrains imposed upon the business by manufacturing capabilities.
5. Leader - manufacturing is leader who shapes, and is actively involved in defining, business strategy.

- Investigation Facet 2, Organizational involvement

This facet of investigation is defined in operational/measurable terms by Schwenk (1986) and King and Rodriguez (1981). Organizational involvement, as they suggest, deals with the extent to which the organization, in term of its various parts and levels, participates in the strategy development process.

For the research, one central questions will be investigated regarding organizational involvement in the manufacturing strategy process.

5. Functional areas involved in the manufacturing strategy development process

- Investigation Facet 3, Information Flow

This facet of investigation is defined in operational/measurable terms by Anderson et al. (1991) and Fine and Hax (1985). As they suggest that at it most basic level, the processes of manufacturing strategy (as any functional and other strategies) require communication of information which describes, accounts for, or plans capabilities and performance.

For the research, three central questions will be investigated regarding the information exchange in the manufacturing strategy process.

6. The managerial perceptions of critical information input from those *functional areas* involved to the development of manufacturing strategy

7. The managerial perceptions of critical information input from *top-management of the firm* to the development of manufacturing strategy

8. The managerial perceptions of the patterns of information flow involved in the development of manufacturing strategy

- Investigation Facet 4, Performance Assessment and Reward Systems

This facet of investigation is defined in operational/measurable terms by Stonich (1980 and 1981) and Northcraft and Wolf (1984). Performance assessment and reward systems, as they suggest, deal with the extent to which such systems are supportive of the strategy.

For the research, two central questions will be investigated regarding performance assessment and reward systems in the manufacturing strategy process.

9. How performance assessment is carried out for manufacturing?

10. Its tie into the reward systems

- Investigation Facet 5, Formalization and Communication

This facet of investigation is defined in operational/measurable terms by Hax and Majluf (1988) and Anderson et al. (1991). Formalization and communication, as they suggest, deal with the extent to which the strategy is documented, reported, and communicated throughout the organization.

For the research, two central questions will be investigated regarding formalization and communication in the manufacturing strategy process.

11. The degree to which manufacturing strategy is documented

12. The degree to which manufacturing strategy is communicated within and beyond the boundary of production system

As Hax and Majluf (1988) suggest that the degree of strategy is being documented and communicated can be delineated on a continuum of formalization:

1. No evident manufacturing strategy
2. Not written, not well verbalized
3. Written form, held closely, few know
4. Written form, verbally communicated
5. Written form, widely disseminated

- Investigation Facet 6, Planning Anchors and Decision Aids

This facet of investigation is defined in operational/measurable terms by Huff and Reger (1987). Planning anchors and decision aids, as they suggested, deal with the fundamental base on which a strategy is defined and analytical framework applied by management in the definition, construction, and evaluation of strategy.

For the research, two central questions will be investigated regarding planning anchors and decision aids in the manufacturing strategy process.

13. The extent to which the development of manufacturing strategy is tied to the annual budgeting process

14. The extent to which the development of manufacturing strategy is tied to analytic and systematic techniques and procedures

These above *six essential facets of investigation* and those *14 investigation questions* central to them will be applied to the empirical investigation for exploring and delineating the paradigm of manufacturing strategy process in the actual context of China's SOEs in the research (see Chapter 5, section 5.3.1).

➤ **Analytical Template for Categorizing the Patterns of Strategy Process**

The process pattern of strategy development in the actual context of organization is best categorized in the work of Bailey and Johnson's (1993) "*Strategic Decision-making Profile*". Based on their intensive field studies on managerial perceptions of the organizational processes involved, Bailey and Johnson define and formulate a *six-dimension profile* for characterizing and categorizing the strategy process pattern. In order to formulating the analytical template for the research, each dimension of the profile is deconstructed to identifiable characteristic statement singularly attribute to each of them based on the discussion on those essential facets of investigation defined in the previous section.

• *The Planning Dimension*

Strategic planning is perhaps the most traditional view of how strategy processes are organized. This dimension of the profile indicates that strategy process is a distinctly intentional process involving a linear, rational, and planned approach to the organization and its environment. Further it implies that through the application of appropriate analytical and systematic techniques the 'right' decision can be taken. The strategic decisions are the outcomes of sequential, planned and deliberate procedures and are often the responsibility of specialized departments. Clearly and well-defined strategic goals and objectives are set by senior management of the organization (Chaffee, 1985). These goals may be a reflection of shareholder values or reflect potential threats and opportunities which organization becomes aware of through its constant monitoring of the business environment. As a goal or strategic issue is defined, the organization and its environment are systematically analysed in terms of (for example) strategic position, the position of competitors, organizational strengths and weakness, and resource availability. The information collected is assessed and strategic options capable of attaining the goal or resolving the strategic issue are generated.

These strategic options, or course of action, are systematically assessed against the criteria of the strategic goals and objectives to be achieved. This evaluation incorporates an assessment of both the estimated consequences of the alternative course of action, for example in terms of risk versus return, and the value of these consequences. Similarly the long-term potential of the options are estimated. The option which simultaneously is perceived to maximised the value of outcomes, best fits the selection options is subsequently detailed in the form of precise plans and programmes and it passed from the top downwards within the organization. Throughout this process strategies are determined and guided by those decision-makers in senior management positions and are implemented by those below who act on but are unlikely to decide on strategy (Mintzberg and Water, 1985).

In line with the systematic development of the strategy, the resources required for implementation are determined and appropriately allocated, and similarly the systems for monitoring and controlling the new strategy are determined. It is argued that strategies developed through this planned, sequential routine should be implemented fully and in a 'surprise free' manner. This formalisation of strategic planning, though appealing, is problematic, and indeed has inherent dangers. In particular it lacks consideration of the less 'objective' aspects of the organization and their critical influence on strategy development.

Characteristic Statement of Planning Perspective of Strategy Process	
- linear progression of distinct analytical steps	-use of analytic tools to interpreting and determining option
- standardised planning procedures	-dominated role of top management
- planning departments	-low level involvement of functional management
-systematic data collection and analysis	-top-down hierarchical process
-explicit strategy	

- *The Incremental Dimension*

The incremental perspective of strategy process suggests that developing strategies through linear, rational, and sequential planning mechanisms was unrealistic. It argued that, given the complexity of organizations and the environments in which they operate, managers can not consider all possible options in terms of all possible futures and evaluate these against preset, unambiguous objectives. This is particularly so in an organizational context in which there are likely to be conflicting views, values and power bases. Rather, strategic choice takes place by comparing options against each other and considering which would give the best outcome and be possible to implement. Quinn (1980) called this strategy building through '*successive limited*

comparisons', but argued that it took place in the everyday world of managing, not through planning systems. Quinn's (1980) study of nine major multinational businesses concluded that the management process of strategy could best be described as *logical incrementalism*. By this he meant that managers have a view of where they want the organization to be in years to come but try to move towards this position in an *evolutionary* way. This mode of strategy development is not seen as the sole responsibility of top management and corporate centre. Those in the lower levels of the organization and the organization's 'subsystems' are actively involved. Indeed it is the strategic subsystems, each of which is concerned with different strategic issues, which raise the awareness of potential strategic problems. Here managers accept the uncertainty of their environment because they realised that they cannot do away with this uncertainty by trying to 'know' factually about how the environment will change. Rather they seek to become highly sensitive to environmental signals through constant environmental scanning and by testing and developing strategies in a step-by-step process of experimentation and limited exposure to the business environment.

Through ongoing analysis, assessment and incremental refinement, changes in the environment are matched with changes in procedure (Schwenk, 1988). This iterative process ensures the strengths of an organization are retained as experimentation and learning undertaken without excessive risk to the organization. Throughout the process potential options are eliminated or encouraged in accordance with their assessed appropriateness; the process does not operate to identify the best and optimal solution (Mintzberg et al., 1976). Quinn (1980) also suggests that different decisions should not be seen as entirely separate. Because the different organizational subsystems are in continual state of interplay, the managers of each know what the others are doing, and can interpret each other's actions and requirements. They are, in effect, learning from each other about the feasibility of a course of action in terms of resource management and its internal political acceptability. Moreover, this constant readjustment and limited commitment allows the organizational mix of resources and capabilities altered in reaction to environmental changes the process broadens the information base available, builds organizational awareness and increase the active search for opportunities and threats not preciously defined. Further, the development of strategy in this way means that the implications of the strategy are continuously being tested out. This continual readjustment does, of course, make a lot of sense if the environment is considered to be a *continually changing influence* on the organization.

Characteristic Statement of Incremental Perspective of Strategy Process	
<ul style="list-style-type: none"> - constant scanning of the environment - on-going adjustment of strategy - small scale trial and error approach - formulation and implementation are interlinked 	<ul style="list-style-type: none"> -lack of analytical information to assist decision making -decision-making is influenced by unexpected events -active role of functional managers

- *The Political Dimension*

The strategy processes can also be explained in political terms. Organizations are political entities and, as such, powerful internal and external interest groups influence the inputs into decisions. These interest groups, each of which has different concern, may be in conflict; there may be difference between groups of managers, between managers and shareholders, or between powerful individual. These differences are likely to be resolved through processes of bargaining, negotiation or perhaps edict; with the result that goals and objectives, strategic issues and even strategies are derived from this political process and not merely from an analytical neutral assessment and choice.

The political processes and the strategies followed by an organization are susceptible to both internal and external influences by stakeholders (Hickson, 1986). Detailed discussion on stakeholders of the organization has been presented in earlier section (see section 4.2). In short, stakeholders refer to any *group or individual* who can affect or is affected by the achievement of the organization's objectives, which could include customers and clients, banks, trade associations, shareholders, suppliers, government departments and agencies, competitors, and organization members. The level of influence these stakeholders are able to exercise differs (Heller, 1988) and is often conditional upon the organization's dependency upon these groups for a resource and the potential difficulty in replacing the present stakeholder as the source of that resource (Hickson, 1986). Similarly the influence of a stakeholder is not constant from decision to decision. The decision situation determines the level of stakeholder involvement and both their level of influence and the dynamics of that influence throughout the process.

Powerful *individuals and groups* may also influence decision through the provision of information. Information is not politically neutral, but rather as source of power, particularly for those who control that which is seen to be important; so the withholding of information, or the influences of one manager over another because that manager controls sources of information, can be important (Peffer, 1978). Strategic decisions, then, are taken based on information distorted by the preferences of the information providers rather than on information, which is neutral. It would be wrong to assume that the identification of key issues and even the strategies eventually selected emerge in a political neutral environment. Differing views will be fought for, not only on the basis of the extent to which they reflect environmental or competitive pressures, for example; but also because they have implications for the status or influence of different stakeholders. Through compromise and mutual adjustment a commonly acceptable strategy will emerge. This strategy will finally be adopted because it is acceptable to both those interest groups influencing the decision-making processes and those who must implement the strategy, and not solely because it fulfils any objective criteria (Johnson, 1987).

Characteristic Statement of Political Perspective of Strategy Process
<ul style="list-style-type: none"> - Organizations are social networks rather than hierarchies - Different interest group exist in the organization - External interest groups also have strong influence over strategy - Debate and discussion are used to generate solutions - Strategy became acceptable through mutual adjustment - Managers draw on formal analysis is just complementary

- The Cultural Dimension

Traditionally strategy has been viewed as the planned response of the organization to its environment. However, the strategies an organization follows can also be attributed to *cultural factors*. Organizations faced with similar environments will respond differently. The strategies they choose to pursue will not result solely from a precise planned approach to the environment and internal conditions, but under influence from the attributes, values and perceptions, which are common among the members and stakeholders of that organization. Further, management cannot be conceived simply in terms of the manipulation of techniques or tools of analysis. Management is also about the application of managerial experience built up over many years; and often within the same organization or industry. Nor do managers typically work in isolation; they interact with others. Their experience is not only rooted in individual experience, but on group and organizational experience built up over time. It is important therefore to recognise the significance of cultural aspects of management involved in strategy process of the organization.

By *organizational culture* is meant the 'deeper level of basic perspective and beliefs that are shared by members of an organization, that operate unconsciously and define in a basic *taken for granted* fashion an organization's view of its self and its environment' (Schein, 1985). A cultural perspective suggests, then, that managerial experience is likely to be based on taken-for-granted *frames of reference* which are brought to bear by a manager – or group of managers – and which will affect how a given situation is perceived and how it is responded to. Over time this taken for grantedness is likely to be handed on – or 'inherited' – within a group. Just as these frames of reference exist at the group level and subunit level they also exist on organizational level and industrial level, or indeed at a national level (Spender, 1989). However, especially important for the strategic management of most organizations is the organizational frame of reference, which is termed by Bailey and Johnson (1993) and Johnson (1987) the "organizational paradigm". An organization's paradigm is, then built up from different influences such as history and past experience (both personal and organizational) and may also reflect the desires of particular stakeholders (Mason and Mitroff, 1981). This organizational paradigm allows the experience

gathered over years to be applied to a given situation so that managers can decide upon relevant information by which to assess the need for change, a likely course of action, and the likelihood of success of that course of action. An organization's strategies, then, develop in accord and within the confine of its culture and dominant paradigm.

Characteristic Statement of Cultural Perspective of Strategy Process
<p>-strategy is the outcome of organizational perceptions and routines expressed in the organization's culture</p> <p>-strategic decision-making is a process of social interaction, based on the collective beliefs and understandings shared by the members of the organization</p> <p>-culture influences strategy through providing a framework of reference to the individual of decision-making</p> <p>-strategy takes the form of management's perspective above all rooted in collective intentions</p> <p>-culture and especially ideology do not encourage strategic change so much, as best, they tend to promote necessary shifts in position within the organization's overall strategic perspective</p>

- *The Command Dimension*

The strategic decision-making processes can also be seen as shaped by a command vision, which represents the desired future state of the organization, and which is initially or/and primarily associated with an individual (Rowe et al., 1989). One explanation suggested by Bailey and Johnson (1993) for the source of this command vision is that it results from the *intuition* and a *rational* understanding of the organization's strategic problems. This understanding is developed through exposure to, and experience of, the important strategic issues of an organization and enables innovation to be made through the adding of new to the well understood and certainty of the old.

However, visionary command might also be seen as the capacity of managers more generally to envisage rather than plan, the future of their organization. It can be argued that some market environments are so turbulent that trying to forecast, predict or plan what they will be like is futile. On the other hand experienced managers have a feeling for what makes sense in these markets and can make decisions about the future on this basis. In this case, the notion of visionary capacity is not limited to the leadership role of the organization, but is seen as a more general aspect of management.

Regardless how it emerges, for a command vision – however appropriate to the organization – to develop into strategic decisions it must be effectively articulated and communicated. The transformation of a vision into strategy is not unidirectional: a vision must be shared and receive assistance if it is to be realized. The authorization for a vision's pursuit comes from its acceptance by the organization's members who 'contract in' to a vision, and facilitate the vision's enactment (Conger, 1987). A visionary alone cannot turn a vision into strategy.

Characteristic Statement of Command Perspective of Strategy Process
<ul style="list-style-type: none"> -strategy making by the dominant leader -simple and informal process -decision-making is mainly through leader inspiration and intuition

- *The Enforced Choice Dimension*

In this dimension of the process organization, as Bailey and Johnson (1993) noted, factors in the environment impinge on the organization in such a way as to select and encourage the adoption of organizational processes, structure and systems which best fit the environment. These external constraints operate to prescribe strategic decisions and sharply limit the role organizational members play in their selection. Equally the strategies an organization can follow tend to be common to all organizations within their industrial sector or market; their ability to make strategic decisions outside these is restricted.

While intentional strategic choice may be restricted, strategic change does occur. Initially changes occur within an organization through variations in its processes, structure and systems. While the process of organizational innovation and variation may come about as a rational intentional response to the environment, they may occur equally unintentionally, through conflict over control of resources; ambiguity of organizational reality; accident; errors; tactical moves; and luck (Aldrich and Mueller, 1982). It is variations, however they occur, which produce the potentially advantageous or dangerous innovations for an organization. Those variations which positively fit the environment and which are appropriate and beneficial to organization are selected and retained, while those which do not, fail and die or are altered to match the environment. It is these successful variations, which match changes in the environment, which produce advantage and so contribute to the likelihood of an organization's or subunit's survival. These successful variations are retained and subsequently disseminated throughout the organization and across its generations through culture, symbols, socialization, and training.

Characteristic Statement of Enforced Perspective of Strategy Process

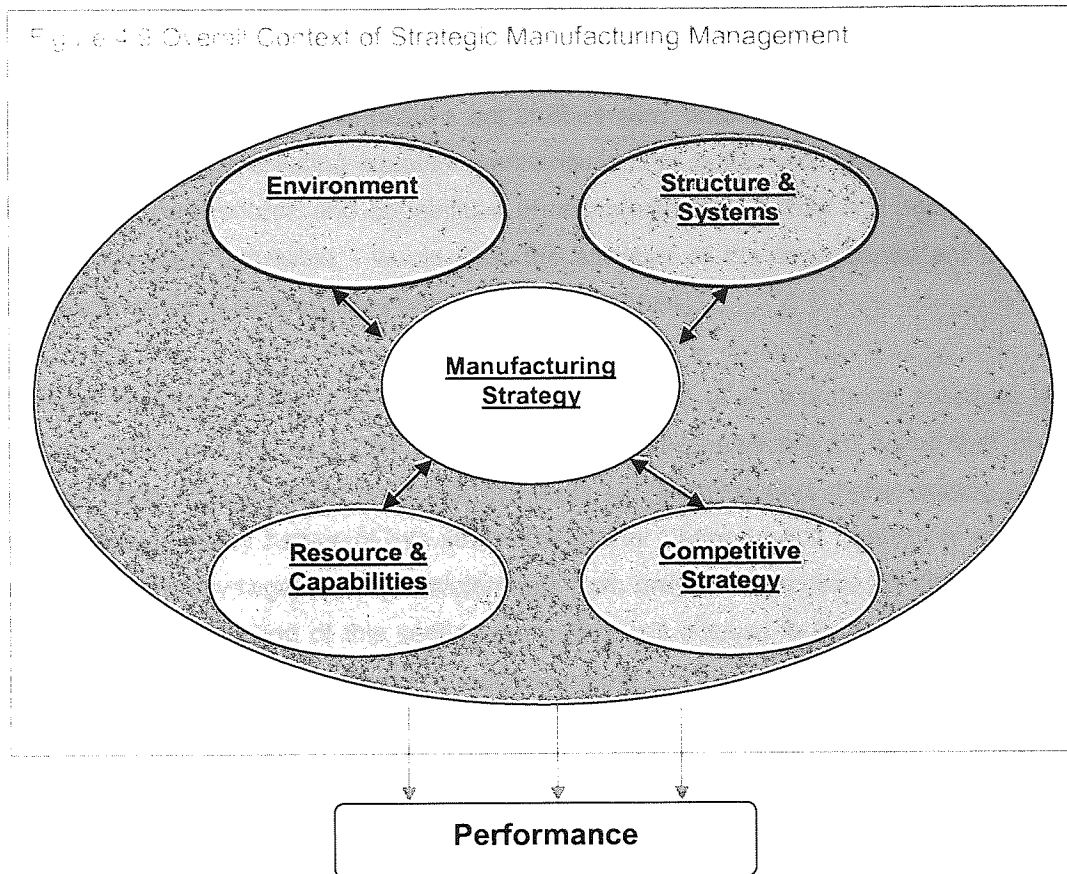
- powerful outside agencies impose a strategic choice
- macro operating context and changes there in strongly influence firm's micro operating context
- management's ability to make strategic decision is restricted by the framework impose by outside agencies

To summarize thus far, as such noted by Bailey and Johnson (1993), it is unlikely that any one of these dimensions in isolation would adequately capture the complexity and patterns of the strategy processes operating in the actual context of the organization. Indeed, as Bailey and Johnson suggest, these different dimensions of the profile are not mutually exclusive and in most organizations managers see strategy processes through a mix of such dimensions. The significant and dominant patterns of strategy processes is upon *where*, *when*, and though *who* you look into it.

4. 3. 2. Analytical Framework for Investigating the Context of Manufacturing Strategy

The effective set of content and process of strategy development, as Mintzberg (1990) suggested, is contingent upon the specific context in which it occurs both organizational and environmental of business operations. The specifics of manufacturing strategy development, both its contents and its processes, are contingent and should be determined upon a number of factors in the overall context of business operations (Schroeder et al., 1986; Fine and Hax, 1985; Hayes and Wheelwright, 1984). In accordance with these views, it must be emphasized that effective use and refinement of a strategy development framework, either to its content or to its process, has to be conducted with substantive understating of the embedded 'context'. If however, contextual contingencies are to be considered very important as discussed in the literature, there has to be provision for attributing subjective meaning to the embedded context of manufacturing strategy development. In this section, the author will establish the provision through constructing an analytical framework for investigating the overall context within which manufacturing strategy development is considered and determined.

Many researchers have offered conceptual models, which consider some of the linkages between manufacturing strategy development and competitive strategy, environment, structure (Miller and Mintzberg, 1983; Kotha and Orne, 1989; Leong et al, 1990; Parthasarthy and Seti, 1992). Of special note is the work of Ward et al (1996, p.598) in which an analytical framework of the overall context of manufacturing strategy development is devised with composition of competitive strategy, organizational structure and systems, and environment. As they suggest these three elements are held to be the most critical contextual aspects with respect to the manufacturing strategy development. The thesis of their argument is that manufacturing strategy, competitive strategy, structure and systems, and environment are often interlinked such as tight constellations of mutually related elements. Based on their work, the author aggregates resources and capabilities of the business as another contextual aspect, which has been proven that so often influences and sometimes determines the development of manufacturing strategy (Rumelt, 1984; Barney, 1991; Grant, 1991). Figure 4.9 illustrates the overall context of manufacturing strategy development applied in this research.



There is a primary link between *competitive strategy* and *manufacturing strategy*. Functional strategies “add detail to business competitive strategy” (Thompson and Strickland, 1990, p.40), and their primary role is to support (internal/external) the overall business strategy. However, mutual causality applies because manufacturing strategy is often advanced as a source of competitive advantage (Buffa, 1984; Hayes and Wheelwright, 1984, Hayes, 1985; Skinner, 1978, 1985), suggesting that manufacturing strategy can have a significant effect on competitive strategy of the business.

Manufacturing strategy has been long hypothesized to have a strong bi-directional link with *environment*. This hypothesis is supported by Swamidass and Newell’s (1987) empirical findings reporting a strong relationship between perceived environmental uncertainties and manufacturing strategies.

Mutual causality also exists between *strategy* (whether competitive or manufacturing) and *structure and systems* of the organization. Porter (1980) illustrates that business strategies have an influence on structure and control systems of the organization. Conversely, structure can influence competitive strategy (Miller, 1986). The existence of an important link between manufacturing strategy and structure is suggested by Nemetz and Fry (1988).

The existence of a mutual causality between *manufacturing strategy* and firms *resource and capability* has been a major thesis of Resource Based View (RBV) of the firm. RBV provides

insights into the important role of manufacturing strategy in creating firm-level distinctive competence of business operations. Within this framework, the manufacturing strategy task is to build resources base and competitive capabilities over time as a mechanism for enacting the environment and for creating isolated mechanisms that buffer the firm from imitation (Rumelt, 1984). Also, the resource and capabilities of manufacturing - if they are unique, valuable, non-substitutable, and inimitable - would lead the strategy of the firm, consistent with stage four manufacturing described by Hays and Wheelwright (1984).

However, as Miller (1986, p.237) suggests, the concept of environment, structure and control system, resources and capabilities, and competitive strategies are so broad that one can only select a representative set of factors or elements for reflecting and characterizing each of them. Given the exploratory nature of this study, the author defined each contextual aspect only with those most critically regarded factors/elements from previous empirical studies in the light of the literature. In the following of this section the author will discuss in detail each contextual aspect and critical elements of investigation chosen to reflect it.

➤ Environment

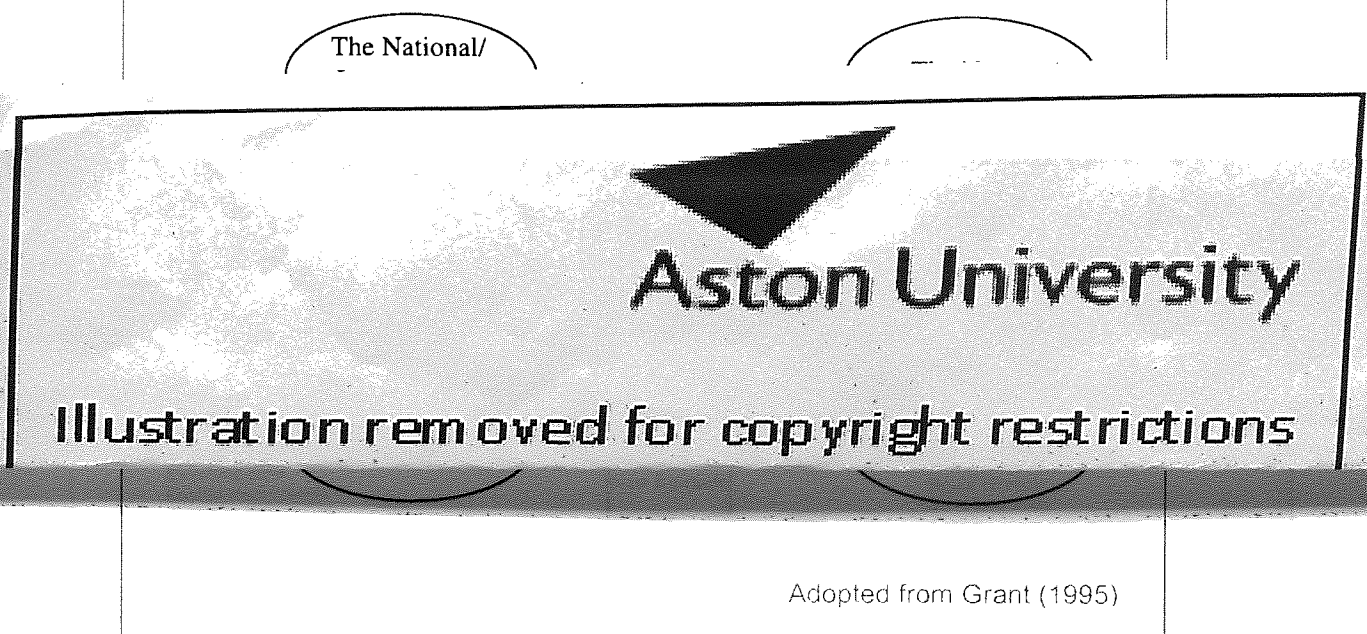
The emphasis on the external environment reflects the dominant themes in business strategy literature during the 1970s and most of the 1980s. During this period, most developments in strategic analysis concentrated on the industry environment of the firm and its competitive positioning in relation to its rivals. During 1980s, the analysis of industry structure and competitive positioning was closely associated with the work of Michael Porter at Harvard, the analytical approaches of consulting companies (e.g., the Boston Consulting Group's analysis of the role of experience and market share in driving relative costs), and the Strategic Planning Institute's PIMS project, which explored the impact of industry structure and competitive positioning on business unit profitability.

(i) From Environmental Analysis to Industry Analysis

The external environment of business operations consists of all sources of environmental influence that impact a firm's decision-making and ensuring performance. The problem here is that, given the vast number and range of environmental influences, how can management monitor, let alone analyse, environmental context of organization? The starting point is some kind of system or framework for organizing information. For example, environmental influences can be classified by source into economic, technological, demographic, social, and governmental factors; or by proximity: the "micro-environment" or "macro-environment". The *perquisite for environmental analysis*, pointed out by Grant (1991, p.53), is to distinguish the vital from the merely important. As he suggested that for the firm to make profit it must create value for customers. Hence, the firm must understand its customers. Second, in creating value for

customers, the firm acquires goods and services from suppliers. Hence, the firm must understand its suppliers and how to form business relationships with them. Third, the ability to generate profit from value-adding activity depends on the intensity of competition among the firms that vie for the same value-creating opportunities. Hence, the firm must understand competition. Thus, the **core** of the firm's environment is formed by its relationship with customers, suppliers, and competitors. This is the firm's industry environment. This is not to say that macro-level factors such as general economic trends, changes in demographic structure, or social and political trends are unimportant to strategy development. These factors may also be critical determinants of the threats and opportunities a company will face in the future. The key issue is how these more general environmental factors impact the firm's industry environment. By focusing on the industry environment, suggested by Grant (1991, p.53), management can determine which of the macro-level influences are important for the firm and which are not. He also provides a conceptual framework for analysing business environment (see Figure 4.10).

Figure 4.10 Environmental Context of the Business



(ii) Analysing Industry Environment

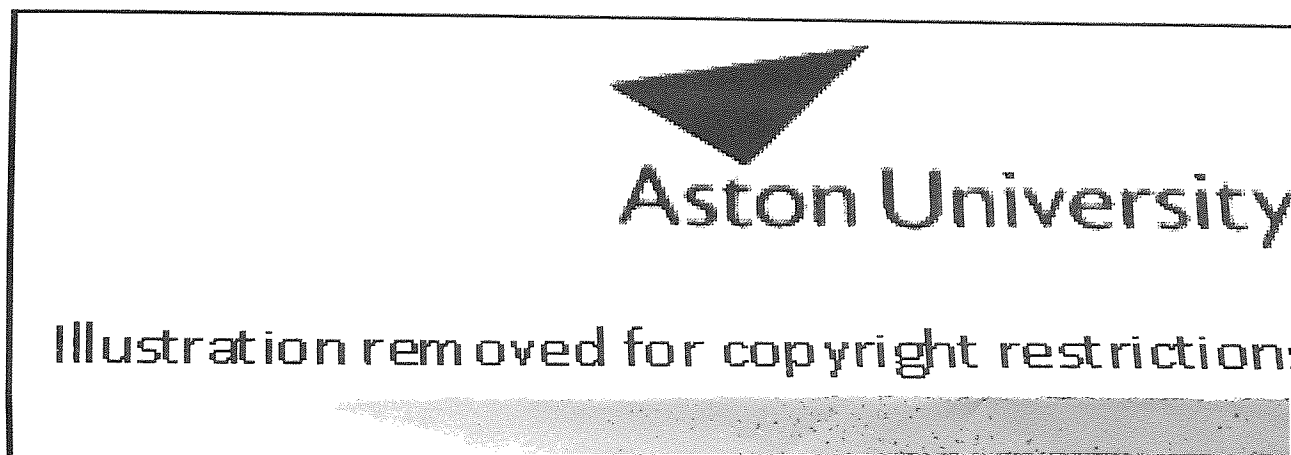
Most of Industrial Organization (IO) research on business, corporate, and industry profitability tests propositions about the causes of 'differential performance'. The primary tradition made industry the nit of analysis and sought a link between industry concentration (and entry barriers) and industry profitability (usually measured with pooled data). A second tradition focused on inter-firm differences in performance, seeking explanation first in terms of firm size and later in terms of market share. The early reaction against the mainline tradition viewed the concentration-profitability correlation as an artefact induced by the deeper share-profitability link. Finally, the

stochastic and efficiency views explain both firm profitability and market-share, and thus concentration, in terms of exogenous differential firm efficiencies.

Although there are at least five distinct schools of thought within the IO field – neoclassical economics, Bain/Mason structure-conduct-performance (SCP) models, Schumpeterian economics, the Chicago tradition, and the Coase-Williamson transactions cost perspective - the SCP paradigm and the transaction cost perspective both offer much to manufacturing strategy researchers. The SCP paradigm (Porter, 1980) proposes that a firm's performance depends on the characteristics of the environment in which it competes. Industry profitability is determined by industry structure, which is a function of barriers to entry, number and size of competing firms, demand elasticity, and differences among competitors, and other characteristics. The SCP paradigm provides its major contribution in framing the sources of environmental influence over industry profitability, explicating the role of entry barriers, and then explaining the degree to which imitative competitive behaviour can drive down overall industry profits.

A helpful, widely used analytical framework for classifying and analysing these factors is that one developed by Michael Porter of Harvard Business School. Porter's Five Forces model (1980) views the profitability of an industry as determined by five sources of competitive pressure. These five forces of competition include three sources of "horizontal" competition: competition from substitutes, competition from entrants, and competition from established rivals; and two sources of "vertical" competition: the bargaining power of suppliers and buyers. The strength of each of these competitive forces is determined by a number of key structural variables (see Figure. 4.11).

Figure 4.11 Five Forces Model of Industrial Competition Analysis



of substitutes
Switching costs
Buyer propensity to
substitute

Adopted from Porter (1980)

However, Miller and Friesen (1984) and Miller (1987) suggest, business always selects very specific industry segment, market niche, and customers group for attention. Thus, for strategic management and its research, as they suggest, we should concentrate on specifically defined parts of an environment rather than on overall industry parameters. The later will provide the big picture for locating and making sense of the former and the former can only be gauged by assessing managers' perceptions of their actual operating environment (Dess and Beard, 1984). There are no industry-wide statistics that could serve this purpose (Bourgeois, 1980; Downey, Hellriegel, and Slocum, 1975; Ducan, 1972). Perceived measures were also expected to have the strongest associations with business strategy since it is perceptions that strategist act on (Bourgeois, 1980; Miller and Friesen, 1984). From the above, **dynamism, heterogeneity, and hostility** are held to be the most critically regarded environmental factors with respect to strategy development in the business strategy literature (Bourgeois, 1980; Dess and Beard, 1984; Miller and Friesen, 1984; Miller, 1987). The definitions of dynamism, heterogeneity, and hostility used in this research are those of Miller (1987). Environmental dynamism is defined by the amount of change in customer requirements, production/service technologies, industrial policies/government regulations, and modes of competition in firm's principal industry. Environmental heterogeneity is defined by differences in competitive tactics, customer requirements, product lines, channels of distribution, etc. across the firm's respective markets. Environmental hostility is defined by price, product, technological and distribution competition, severe regulatory restrictions, shortages of labour or raw materials, and unfavourable demographic trends. Although conceptually distinct, dynamism, heterogeneity, and hostility are usually correlated. In fact, they are generally correlated to the key components of the overarching construct of environmental uncertainty (Ducan, 1972; Downey et al., 1975; Bourgeois, 1980).

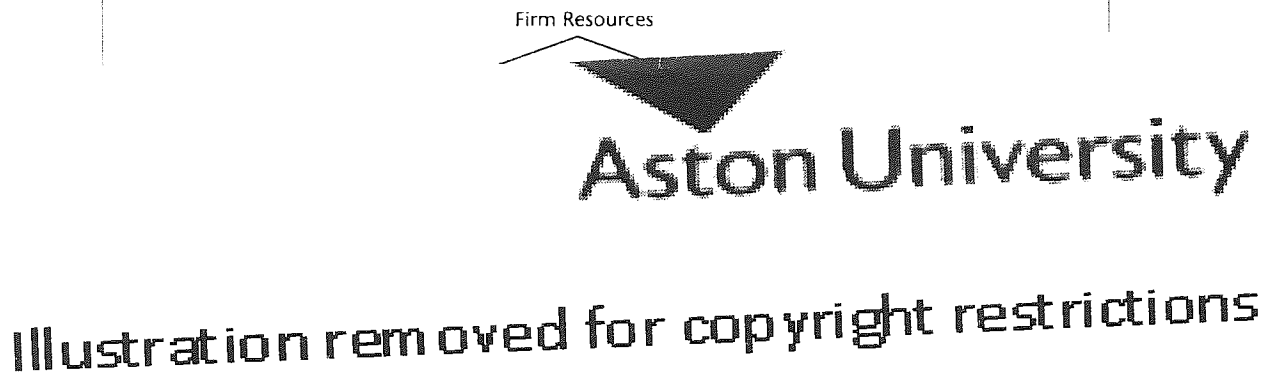
➤ Resources and Capabilities

The resource-based view (RBV) of the firm has had a profound impact on the development of strategy in the contemporary strategic analysis. This perspective of strategic analysis emphasizes that the key to profitability is not doing the same as other firms – locating in the most attractive industries and pursuing the appropriate generic strategy – but exploiting the differences among firms. Each firm is a unique collection of highly differentiated resources and capabilities. Establishing competitive advantage is concerned with formulating and implementing a strategy that recognizes and exploits the unique features of each firm.

Under the broad umbrella of RBV of the firm, there has been a wide range of research into the importance of resources for the success and even existence of firms. Until now no classification of firm resources has emerged that is generally accepted within the field of business strategy and corporate strategic management. Drawing up an inventory of a firm's resources can be surprising difficult. No such document exists within the accounting or management information systems of most corporations. The corporate balance sheet provides a partial and distorted picture of a firm's

assets. As Grant (1991) suggested that a useful starting point is a simple classification of the principal types of resources into tangible versus intangible, and relational resources versus competences (see Figure 4.12).

Figure 4.12 Type of Firm's Resources



Adopted from Grant (1991)

- **Tangible vs. Intangible Resources**

Tangible resources are all means available to the firm that can physically be observed, such as buildings, machines, materials, land and money. Tangibles can be referred to as the 'hardware' of the organization. Intangibles, on the other hand, are the 'software' of the organization. Intangible resources cannot be touched, but are largely carried within the people in the organization. In general, tangible resources need to be purchased, while intangibles need to be developed. Therefore, tangible resources are often more readily transferable, easier to price and usually are placed on the balance sheet.

- **Relational Resources vs. Competences**

Within the category of intangible resources, **relational resources** and **competences** can be distinguished. Relational resources are all of the means available to the firm derived from the firm's interaction with its environment (Lowendahl, 1997). The firm can cultivate specific relationships with individuals and organizations in the environment, such as buyers, suppliers, competitors, and government agencies, which can be instrumental on achieving the firm's goals. As attested by the old saying "it is not what you know, but who you know," relationship can often be an essential resource. Besides direct relationship a firm's reputation among other parties in the environment can also be an important resource. Competence, on the other hand, refers to the firm's fitness to perform in a particular field. A firm has a competence if it has the knowledge, capability and attitude needed to successfully operate in a specific area (de Wit and Meyer, 1998).

The RBV helps clarify the types of strengths and capabilities that will have value and lead to strategic advantage (Barney, 1991; Grant, 1991; and Mahoney and Pandian, 1992). Within the RBV, resources and capabilities that can lead to competitive advantage are those that are valuable and non-substitutable, from the point of view of customers, and unique and inimitable, from the point of view of competitors (Barney, 1991 and Grant, 1995). As Barney (1991) suggested that the task of firm's strategic management was to build capabilities in an integrative manner over time as a mechanism for enacting the environment and for creating isolating mechanisms that buffer the firm from imitation.

The resource-based theory of the firm is useful in explaining the role of manufacturing in creating and sustaining competitive advantage. As noted by Teece et al. (1997), fixed assets such as plant and equipment often may be purchased by all industry participants and, therefore, rarely serve as a source of competitive advantage. On the other hand, firm-specific resources, such as knowledge or complex processes and routines, may serve as a source of advantage. Furthermore, advantages derived from manufacturing routines and processes may be more difficult for competitors to imitate than other organizational resources and capabilities. Custom designed process equipment, worker experience, and the accumulation of incremental process improvements made over time can create a store of firm-specific manufacturing capability that is difficult to observe and almost impossible to imitate (Abernathy and Utterback, 1978; Hayes and Wheelwright, 1984). The causal ambiguity created by these integrated complex systems and routines is one of the cornerstones of competitive advantage within the resource-based view in that it provides for inimitability (Barney, 1991).

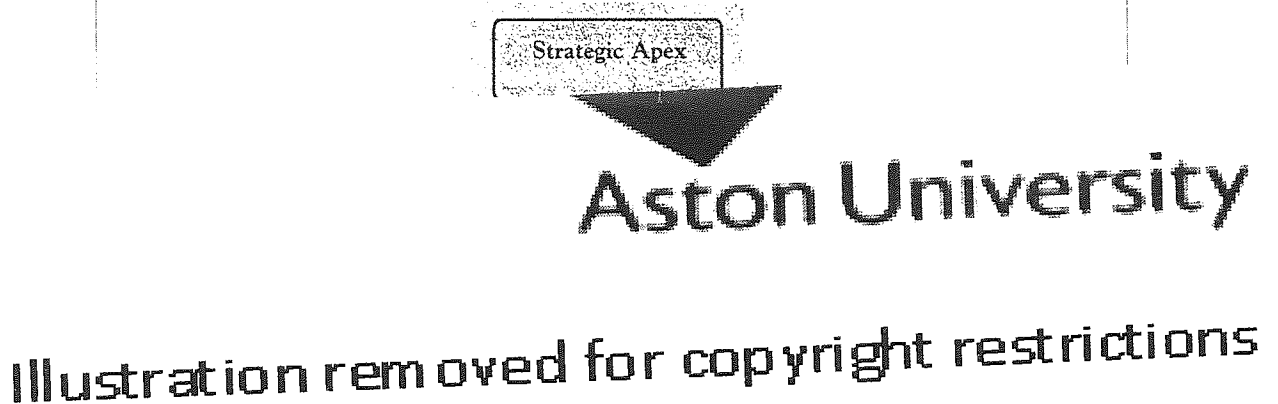
Several researchers have already identified opportunities to apply RBV concepts to manufacturing strategy issues. Teece et al. (1997) apply the arguments of the RBV in explaining decisions to vertically integrate, and in describing dynamic capabilities. Cowton and Vail (1994) used the RBV to guide their mapping of just-in-time manufacturing practices. Also, St. John and Harrison (1999) used the RBV to argue that manufacturing has substantial potential to serve as the basis for corporate level distinctive competence when integration is achieved among manufacturing-related business units. In the later chapters Grant's (1991) analytical frameworks of RBV will be applied to analyse the organizational context of China's State Owned manufacturers in petrochemical industry.

Tangible resource of the business is defined by Grant (1991) as the total asset purchased by the firm that can physically be observed and placed on the balance sheet. **Relational resource** of the business is defined by Grant (1991) as firm's direct relationship with buyers, suppliers, competitors, government agencies, and firm's reputation among other parties in the principal industry. **Competence** of the business is defined by Teece et al. (1997) as the set of unique knowledge, capability, and attitude that enables the firm to achieve competitive edge in the respective area of business operations.

➤ Organizational Structure and Power Systems

The literature has shown that there are very many types of organization structures and control systems. There are also many elements or variables that have been used to reflect and characterize them. Thus, as Miller (1986, p.241) suggests, one should concentrate on only a selection of elements or factors that have already been shown to be important in their possible consequences for strategy development. Of special note, the essential structure of the organization is best defined by Mintzberg's (1979) "The Structuring of Organizations", which defines the six basic parts of the organization (see Figure 4.13).

Figure 4.13 Six Basic Parts of the Organization



Ideology

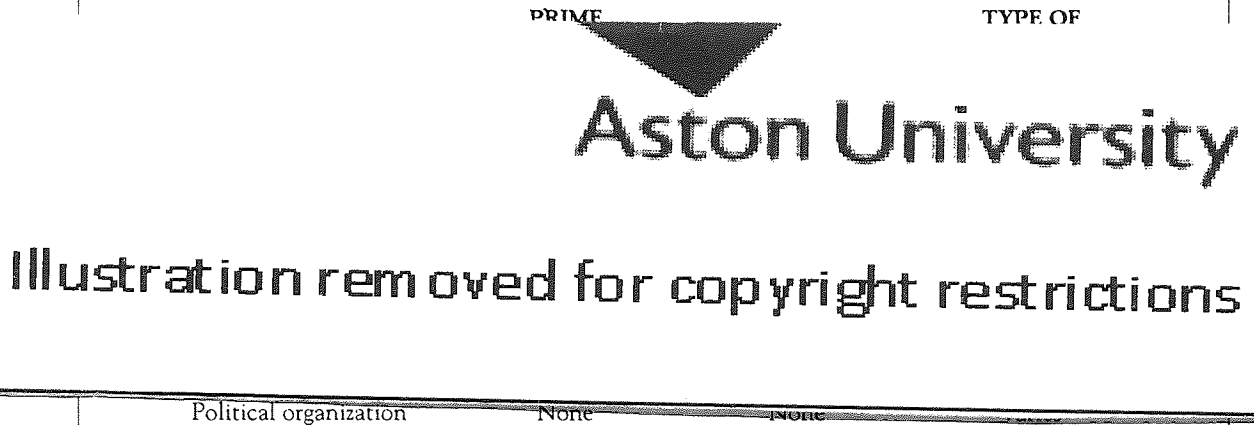
Adopted from Mintzberg (1979)

Mintzberg (1983) went on defining the fundamental power systems of the organization in his work "Power in and Around Organizations". Taking these two together, Mintzberg's (1989) six structural types provide an excellent synthesis of the literature on organizational structure & power system (see Table 4.1).

In reflecting and differentiating these structural types, four most critically regarded factors with respect to strategy development are defined by Miller (1986 and 1988) as the **delegation**, **bureaucratisation**, **specialization**, and **liaison devises**. Such definition is well supported in the business strategy literature, and is to be applied in the empirical study of this project (Mintzberg, 1979; Blackburn, 1982). Delegation is defined as the distribution of decision-making power down the hierarchy of authority to line managers or dispersed out of the line hierarchy to technostructure/supports staff. Bureaucratisation is defined as the using of formalized rules, procedures, standards, and precedents in management control such as cost controls, quality controls, capital budgeting, information management, performance assessment, and personnel appraisals. Specialization is defined as the deployment of professional specialists and

technocrats in organizational control such as engineers, scientists, and functional expertises. Liaison devices are defined as the use of task forces and cross-functional committees to assure compatibility among decisions in one area with those in other areas.

Table 4.1 Configurations of Structure & systems of the organization



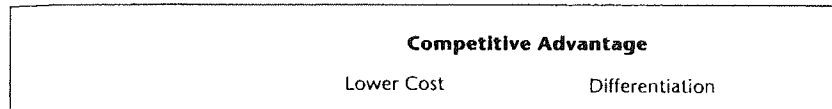
Political organization None None

Adopted from Mintzberg (1989)

➤ Competitive Strategy

Porter (1980) distinguished three 'generic competitive strategies' that firms can pursue to achieve competitive advantage (see Figure 4.14).

Figure 4.14 Three Generic Competitive Strategies



Adopted from Porter (1980)

Cost leadership is a strategy that strives to produce products at the lowest cost in an industry (Hambrick, 1983; Porter, 1980; Miles and Snow, 1978). Much effort is devoted to cost control so that above-average returns can be obtained even with lower prices ((Hambrick, 1983). It stresses efficient scale facilities through heavy investment in fixed assets such as plants and equipments. Cost leaders try to supply a standard, no-frills, high-volume, usually mature product. They pursue cost reductions in production (labour, materials, and overhead), and minimize expenses of product innovation, service, selling and advertising. Process R&D and production automation are pursued to reduced production cost (Abernathy and Utterback, 1975). Differentiation is a strategy aims to create a product that is perceived as uniquely attractive. It emphasizes high quality, high performance, creative, well-designed products, a reputation for reliability, a good corporate image, and strong cooperation from marketing channels (Miller, 1986; Murray, 1988; Porter, 1980; Wright, 1987). Miller (1986) noted that there are at least two different types of differentiation strategies: those based on product innovation and those based on intensive marketing and image management. Innovative differentiators lead their competitors in coming out with new products and new technologies and can charge fairly high prices. There is a strong emphasis on product R&D and pioneering. In contrast, the marketing differentiators strive to improve product quality, performance, service, and boost brand image. These firms spend large sums on advertising, sales forces, promotion, and distribution. Both types of differentiators maintain asset parsimony and strategic flexibility by attempting to keep investments in fix plant and equipment as small as possible (MacMillan and Hambrick, 1983). Focus is a strategy concentrates the firm's attention on a specific type of customer, product or geographic locale. The firm use either a differentiation or a cost leadership strategy within a specialized part of industry.

Given the foregoing, as Porter (1980), Scherer (1980), MacMillan and Hambrick (1983), and Miller (1986 and 1988) suggest, five key management factors that commonly reflect and differentiate competitive strategies are cost control, innovation and R&D, marketing emphasis and expenses, product-market scope, and asset management.

4. 3. 3. Performance Measurements Applied in the Research

While the inclusion of performance aspect in strategy development research is highly desirable, the measurement of performance in empirical studies is always troublesome. In the absence of standards, there is a lack of research using both 'substantive' and 'perceptual' performance measures, so as to eliminate reasonable doubt about the finding. Although objective performance measures are preferable to perceived measure of performance, the latter have been used and recommended as a substitute when objective measures are unavailable (Dess and Robinson, 1984). Much of the literature speaks of business performance as a multi-dimensional construct. However, much of the current research on relies on a single measure of business performance. These measures have not always been consistent with the bases for competition of the business. Also, units of analysis in existing research have not always been consistent with performance measurements. For example, manufacturing strategy studies frequently assess strategy development practice at a functional or plant level while performance is measured at the SBU level. At the same time, very few empirical works have address linkages between the two levels. As Swamidass and Newell (1987, p 516) suggest, the appropriateness of the performance measure to use depends on the circumstances unique to the study.

➤ Business Performance Measurement

Growth is one frequently used measure of business performance (Dess and Robinson, 1984). In this study, growth was the favoured measure of business performance. However, instead of using growth in a single aspect of performance, growth in three major aspects of business performance were aggregated into a composite measure of growth: growth in sales, growth in operating profit, and growth in net profit. The use of growth as the measure of business performance has a special appeal for this study. In the years preceding the fall 1999, when data were first collected for this study, China's petrochemical industry represented in this study was faced with severe challenges of the substantial increase in the weighted average price of crude oil and increasing competition from abroad. Under these circumstances, growth provided a more rigorous test of performance than perhaps any other measure of business performance that could have been devised.

➤ Competitive Performance Measurement

Competitive performance has been measured with "substantive" measures like the statistical ranks of the company's production capacity, production efficiency, and sales of principal products in the industry, its principal products' market share in the domestic market.

Competitive performance has also been measured with self-reported "perceptual" measures from the management in related to the bases for competition of the company like *cost control* (production cost, operating expense, overheads), *product/service differentiation* (product/service development, brand identification, marketing emphasis and expenses, control of distribution channels), *asset management*, *product-market scope*.

➤ Manufacturing Performance Measurement

Manufacturing performance has been measured with both substantive and perceptual measures in related to the stressed competitive priorities of production by the company. The use of appropriate measures has been subject to specific priority stressed and specific aspect of performance measured. The following table sets out the details of performance measurements applied in this study:

Table 4.2 Manufacturing Performance Indicators

Manufacturing Performance Indicators			
<u>Cost</u>	<u>Quality</u>	<u>Delivery</u>	<u>Flexibility</u>
- production cost (S/S)	- improve conformance to design specification (S/S)	- meet delivery promise (S/S)	- make rapid volume change (S/P)
- inventory level (S/S)	- statistical/real-time process control (S/P)	- provide fast delivery (S/P)	
- facility utilization (S/S)	- offer consistent reliable quality (S/P)	- lead-time reduction (S/P)	- adjust product mix (S/P)
- capacity utilization (S/S)	- high performance product (S/P)		
- labour productivity (S/S)			
S/S: substantive/statistical measurement; S: substantive measurement; P: perceptual measurement			

4. 4. Conclusion

In the foregoing three sections this chapter had demonstrated how "theoretical framework" of the study is constructed namely theoretical perspective and design of the research. The author has integrated concepts, constructs, and essential facets of investigation from the business strategy literature while at the same time firmly based on the theoretical foundation for manufacturing strategy. In so doing, the empirical study could not only benefit from those well-established themes on the paradigm of strategy development in the business strategy literature but also reflect the essential characteristics and critical need of manufacturing strategy.

To recap, theoretical perspective of the research has been defined as the integrative school of configuration research on the paradigm of strategy development. Following this theoretical perspective, the construction of theoretical design begins with defining the overall context of strategic manufacturing management within which developing manufacturing strategy is considered and determined. An analytical framework has been constructed by the author whereby the most critical contextual aspects with respect to the manufacturing strategy development have been identified from the literature. The content of manufacturing strategy has been subject to much more conceptual development in the literature than context and process issues. Although there are critical limitations from a theoretical perspective as discussed earlier, the existing content model has clearly defined in operational/measurable terms the concept and critical elements of manufacturing strategy content. There is general agreement, as discussed in the literature, on the conceptions and constructs defined. Based on the existing content model in the literature, an analytical framework has been devised by the author for organising empirical investigations in the research. Following the theoretical perspective defined above, the author has identified six essential facets of investigation from the business strategy literature to delineate the strategy development process. These six essential facets have also been defined and applied partly by many previous empirical studies on manufacturing strategy process reviewed in the literature. Analytical templates for categorizing the empirical process patterns and overall paradigm explored in the field have also been formulated by the author in the light of those integrative frameworks on the paradigm of strategy development process in the business strategy literature.

Of special note a great deal of attention has been given to the "synthesis" of the 'three dimensions' of strategy development practice - its embedded *context* of consideration, its *content* configuration, and its *process* organization. Each strategy development phenomena is, by its nature, three-dimensional in nature. Only by understanding all three dimensions will the researcher gain any real depth of comprehension of the strategist's perspective in operationalising the underlying concept of strategic management during practice.

5. Research Design & Methodology

5. 1. Introduction

The exploratory nature of this project also has been firmly justified in chapter 3 from both the critical literature review and pre-research field investigations. There are neither hypotheses nor theoretical propositions to be tested in this exploratory project. It is dangerous for "exploratory" research, as Pettigrew et al (1988) suggests, hypothesizing explicit conceptualisation of casual and analytical relationships between variables or constructs in unknown water of the subject. Specially, as they suggest, in studying qualitative, power-behaviour factors, and emergent social processes nested in their context it could reduce the phenomenon under investigation into un-interpretable sawdust.

The main purpose of research design for exploratory case studies, as Yin (1994) suggests, is twofold. First, research design helps to avoid the situation in which the empirical evidence collected does not address the initial research questions, which is quite common field-based drift in an exploratory case study setting. That is to provide a clearly defined scope and perspective of the study. As he suggests, without a conscious attempt at theory building, exploratory studies merely becomes 'data-dredging', or the ad hoc collection and analysis of data for whatever conclusion can be resulted. Second, research design helps to ensure a convincing support of theoretical generalization and conclusion in the empirical evidence. That is to help overcoming researcher's bias and lack of rigor. Therefore, in the most elementary sense, the research design is the logical sequence that connects the empirical data to a study's initial research questions and ultimately, to its conclusions (Yin, 1994, p19).

It follows that in doing exploratory case studies researchers should always try to go into organizations with a well-defined scope and perspective - to collect specific kinds of data systematically, thus research becomes less a matter of 'hit or miss' and more a targeted, focused, and purposeful effort of theory-building towards critical and empirical concerns emerged in the field. At the same time, the researchers should always try to ensure that design and methodology for the empirical investigation is well formulated to enable theory-building process intimately tied with the evidence and theoretical generalization and conclusion firmly grounded in the data.

5. 2. Research Design

For exploratory case study in general, as Yin (1994, p.29) suggests, it commonly calls for less front-end preparation in research design. However, if one's project involves multiple cases or one's objective is to provide freshness in perspective to an existing research topic, necessary front-end preparation is crucial. A well-formulated research design will help researcher to have a clearly-defined scope and perspective of the study, and to overcome researcher's bias and lack of rigor, and to support convincing grounding for comparative analysis and theoretical generalization.

In this later case of exploratory case study, as Miles and Huberman (1984) and Yin, (1994) suggest, four components for a research design are essential:

1. Scope of the research
2. Framework of analysis for the research
3. Unit of analysis for the research
4. Selection of cases for the research

5. 2. 1. Scope of the research

In defining scope of the research, as presented in Chapter 3, groundwork of the research has progressed through three analytical phases in order to ensure that it would address critical and empirical concerns that emerged in the field. In the first phase, it clearly defined the research topic as the manufacturing strategy development practice within contemporary industrial organizations. In the second phase, it further identified the central phenomenon under investigation as the management paradigms and managerial perspectives applied during the practice when operationalising the concept of strategic manufacturing management. In the third phase, through the triangulation of the three groundwork sources - technical literature, pre-research field investigation, specialists' suggestion in the academic institution, subjects of the study were further defined in operational terms with research questions, research objectives and goal of the research.

Research Topic

Strategic Manufacturing Management in Contemporary SOEs within China's Petrochemical Industry



Theoretical Thesis & Theoretical Approach

Using configuration approach to study the manufacturing strategy development practice (its content & its process) in relation to its embedded context and analyse the performance implications of associations between the two.



Central Phenomenon under Investigation

Paradigm of Manufacturing Strategy Development management interpretations & perceptions applied during the practice when operationalising the underlying concepts of strategic manufacturing management



Subject of the Study

Investigate Empirical Specifics and Management Perceptions of the Overall Context of Manufacturing Strategy Development

Investigate Empirical Specifics and Management Perceptions of the Manufacturing Strategy Content

Investigate Empirical Specifics and Management Perceptions of the Process of Manufacturing Strategy Development

- Abstraction Level 1 - Overall Paradigm
- Abstraction Level 2 - Process Patterns



by which the development of manufacturing strategy is organized

The goal of the research is:

To provide a wider contextual contingency and an integrative perspective for the paradigm of manufacturing strategy development from empirical studies conducted in contemporary industrial companies in China, which could be used for the refinement and future development of context-specific analytic methods and decision aids when operationalising the concept of strategic manufacturing management.

The aim of the research is:

To provide in-depth understanding into the *successful experiences* of managing manufacturing strategy development from SOEs within China's petrochemical industry regarding empirical specifics and managerial perspectives on its embedded context of consideration, its content configuration, and its process organization.

The Chief Research Questions are:

1. **What** are the empirical specifics and managerial perceptions about the overall context of manufacturing strategy development in SOEs within China's petrochemical industry?
2. **What** are the empirical specifics and managerial perceptions about the content of manufacturing strategy in SOEs within China's petrochemical industry?
3. **What** are the empirical process patterns by which the development of manufacturing strategy is organized in SOEs within China's petrochemical industry?
4. **What** are the empirical process paradigms by which the development of manufacturing strategy is organized in SOEs within China's petrochemical industry?

And the objectives of the research are:

1. To develop an empirical configuration for conceptualising context-embedded specifics and managerial perceptions on the overall context of manufacturing strategy development in SOEs within China's petrochemical industry.
2. To develop a content configuration of manufacturing strategy in SOEs within China's petrochemical industry for generating context-embedded understanding regarding the empirical specifics and managerial perceptions on "competitive priority" of manufacturing and related "key strategic manufacturing decisions" in putting together desired manufacturing structure, infrastructure, and set of specific manufacturing capabilities.
3. To develop an empirical process configuration for conceptualising the context-embedded specifics and managerial perceptions on process paradigm and patterns of manufacturing strategy development in SOEs within China's petrochemical industry.

5. 2. 2. Framework of analysis for the research

After clearly defining the scope of the research, as Yin (1994, p.22) suggests, the next step in a research design for exploratory case study is to formulate the framework of analysis. The framework of analysis, as he suggests, explains, (either graphically or in narrative form) the main things to be studied within the scope of the research and the angle of research to be applied for studying them. In other words, it defines the theoretical perspective and theoretical design for empirical studies.

Given the critical deficiency of a multidimensional and integrative profile in the existing paradigm from a theoretical perspective identified in Chapter 3, the author follows the suggestion from many others (Adam and Swamidass, 1989; Ward et al., 1990; Minor et al., 1994; Amundson, 1998) to integrate concepts, constructs, and essential facets of investigation from the business strategy literature to study the strategy development practice for manufacturing. However, the construction of framework of analysis is firmly based on the theoretical foundations for manufacturing strategy stated at the outset of this thesis. In so doing, the empirical study could not only benefit from those well-established themes on the paradigm of strategy development in the business strategy literature but also reflect the essential characteristics and critical need of manufacturing strategy. Also the defining of major constructs, key issues of study central to each construct, and essential facets of investigation has its convincing grounding in the empirical evidence collected through the pre-research field investigation.

The construction of framework of analysis has been presented in a very detailed narrative form in Chapter 4. To recap, theoretical perspective of the research has been defined as the *integrative school of configuration research on the paradigm of strategy development*. Hughes (1997), Bozarth and Mcdermott (1998), St. John et al (2001) and many others have suggested the configuration approach as a promising avenue for the future development needed for a 'multidimensional' and 'integrative' paradigm of manufacturing strategy development. In general, as Miller and Mintzberg (1988) noted, configuration approach to strategy development research yields a systematic, multidimensional, and holistic image of the reality, without attributing causation to any of the individual parts of the whole. The distinguishing characteristic of configuration models, as they state, is the establishment of multidimensional and integrative profiles, which are well suited to investigating the holistic, interdependent, and context-embedded organizational phenomena in describing the process, the content, and the overall context of strategy development.

Following this configuration approach, an area of growing importance and school of studies in the business strategy literature has been the development of configuration model to explore, delineate the empirical paradigm of strategy development practices in the given context of contemporary organizations, and to explain the multidimensional and situational nature of the strategy process, which is termed by Huff and Reger (1987) the integrative school of strategy development research. From this school, Mintzberg (1990) suggests, the practice of strategy development is shaped and configured by both deliberate and emergent forces encapsulated within the management paradigm of the organizations (See Chapter 4). However, after Mintzberg (1990), the effective management of strategy development practice involves not only the deliberate or emergent process operating in isolation of one another, but the interplay between the deliberate and emergent processes which act together to realize a successful strategy. As pointed out by Johnson (1988), Mintzberg (1990), Eisenhardt and Zbaracki (1992) and Bailey and Johnson (1993), it's precisely the exploring, delineating, and explaining of the context-embedded and integrative paradigm of strategy development that is the essential concern and central focus of the integrative school of strategy research.

From the theoretical perspective defined above, the construction of theoretical design begins with defining the overall context of strategic manufacturing management within which manufacturing strategy development is to be considered and determined. An analytical framework has been constructed by the author whereas the most critical contextual aspects with respect to the manufacturing strategy development have been identified from the literature. However, the concepts of environment, organizational structure & control system, resources & capabilities, and competitive strategies are so broad that one can only select a representative set of factors or categories to reflect and characterize each of them. Given the exploratory nature of the research, the author defined each the above contextual aspect only with those most critically regarded factors from previous empirical studies in the light of the literature (see Chapter 4 section 4.3.7). The subsequent operations and applications in the field have been sufficiently open and largely improvised by the author for the best possible exploration of the context-embedded configuration of the phenomena.

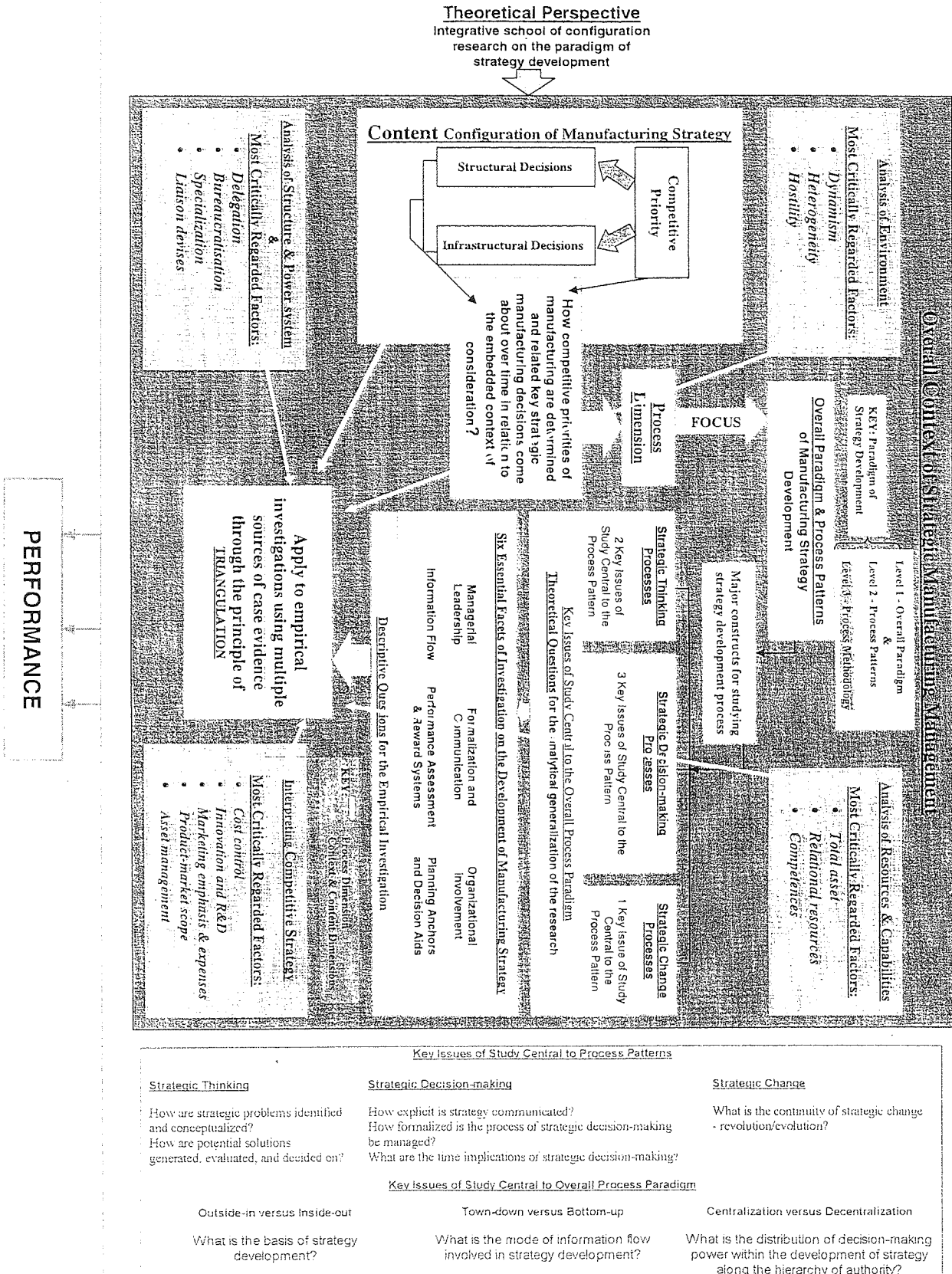
The content of manufacturing strategy has been subject to much more conceptual development in the literature than context and process issues. Although there are critical limitations from a theoretical perspective as discussed earlier, the existing content model has clearly defined in operational/measurable terms the concept and critical elements of manufacturing strategy content. There is general agreement, as discussed in the literature,

on the conceptions and constructs defined. Based on this content model in the literature, an analytical framework has been devised by the author as the template of analysis for organising empirical investigations in the research (see Chapter 3 section 3.6.2 and Figure 3.3). According to the theoretical foundations of manufacturing strategy reviewed at the outset of this thesis, the investigation on the context and content dimensions will build a conceptual platform for the investigation on the process dimension of manufacturing strategy development.

From the integrative school of configuration research on the paradigm of strategy development process, three *major constructs* (strategic thinking, strategic decision-making, strategic change) have been chosen for the study, which have been regarded as the actual organizational processes involved in the strategy development. *Key issues of study* central to the paradigm of each major process construct have been identified through a close exam on critical concerns regarded in the literature using typology of deliberate and emergent strategy. All these key issues have also been regarded as essential to the paradigm of manufacturing strategy development by the empirical evidence from the pre-research field investigation in this study. These key issues are regarded as theoretical questions that need to be answered in cross-case analysis for analytical generalization of the research findings. Given the exploratory nature of this study, six *essential* facets of investigation have been further defined from previous empirical studies on the above key issues in the literature. These six essential facets of investigation on the process of manufacturing strategy development have been defined and applied partly by many previous process studies reviewed in the literature (see Chapter 3). However, despite the frequent overlapping in definitions and applications, the whole set of these six essential facets for empirical investigation on manufacturing strategy development appears first in this study (see Chapter 3). Finally, the analytical templates for categorizing the empirical process patterns and overall paradigm explored in the field have been formulated in the light of those integrative frameworks on the paradigm of strategy development process in the business strategy literature.

Operational performance is measured in this study using both objective and perceptual measures that are specific to and consistent with unit of analysis and bases for competition of the business. Figure 5.1 illustrates graphically the theoretical perspective and design of the research developed by the author.

Figure 5.1 Framework of Analysis for the Research



Key Issues of Study Central to Process Patterns

<p>Strategic Thinking</p> <p>How are strategic problems identified and conceptualized? How are potential solutions generated, evaluated, and decided on?</p>	<p>Strategic Decision-making</p> <p>How explicit is strategy communicated? How formalized is the process of strategic decision-making be managed? What are the time implications of strategic decision-making?</p>	<p>Strategic Change</p> <p>What is the continuity of strategic change - revolution/evolution?</p>
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Key Issues of Study Central to Overall Process Paradigm

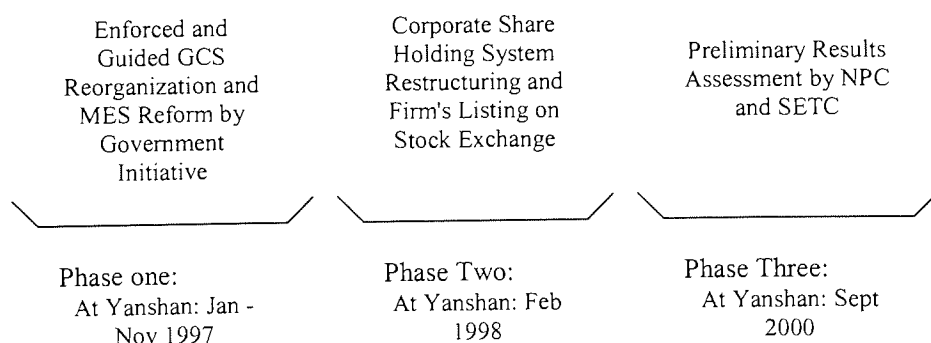
<p>Outside-in versus Inside-out</p> <p>What is the basis of strategy development?</p>	<p>Town-down versus Bottom-up</p> <p>What is the mode of information flow involved in strategy development?</p>	<p>Centralization versus Decentralization</p> <p>What is the distribution of decision-making power within the development of strategy along the hierarchy of authority?</p>
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5. 2. 3. Unit of analysis for the research – defining the case

This third component of research design, as Yin (1994, p.21) suggests, is related to the fundamental issue of defining the "case" of the research. As a general guide, the definition of the unit of analysis (and therefore of the case) is related to the way the research questions have been defined. In fact, as Yin (1994, p.23) suggests, selecting the appropriate unit of analysis results from accurately specifying the primary research questions.

As presented in Chapter 3, the research questions of this project are focused on studying the management paradigms and managerial perspectives applied during practice when operationalising the concept of manufacturing strategy. Manufacturing strategy have been studied and discussed at the corporate, SBU, functional, plant, and department levels. However, both the literature and the pre-research field investigation have identified that the development of manufacturing strategy primarily occurred at SBU level of the firm.

Once the general definition of the unit of analysis has been established, other clarifications in the case become important. First, specific time boundaries are needed to define the beginning and end of the case. As identified through the pre-research field investigation at Yanshan and BIEM, SOEs in China's petrochemical industry started to engage with the routine of manufacturing strategy development only after the GCS/MES reform experiments and corporatization restructuring in 1997. Before that the strategic planning of manufacturing was mainly managed at the corporate centre and with very limited independence and autonomy from government interference. Therefore, the beginning of the case is the GCS/MES reform experiments in 1997 and the end of the case is in the late year 2000 when the preliminary results was assessed by National People's Congress (NPC) and State Economic and Trade Commission (SETC). It has been revealed through the pre-research investigation that Share Holding System restructuring in the petrochemical industry in general and at Yanshan in particular has been through three major phases:



5. 2. 4. Selecting Cases for the Research – multiple-case design

Selection of cases for the research is an important aspect of building theory from case studies. Harris and Sutton (1986), Eisenhardt and Bourgeois (1988), and Yin (1994), to name only a few, suggest that multiple cases offer the researcher a deeper understanding of the cases, better chance to explore, delineate, explain locally grounded configurations, and better precision, validity, reliability of the research findings. Therefore, this project chose to apply a multiple-case design. The further clarifications in this multiple-case design will be discussed below:

1. Defining the concept of population
2. Drawing sample and case companies from the chosen population
3. Within-case sampling

(i) Defining the Concept of Population

As in hypothesis-testing research, the concept of a population is crucial for theory-building case studies, because the population defines the set of entities from which the research sample is to be drawn. Also, selection of an appropriate population controls extraneous variation and helps to define the limits for generalizing the research finding. In this section, the author will explain reasons from which this study has chosen *large-scale SOEs in China's petrochemical industry* as population of the research.

China's economic awakening will undoubtedly go down as one of the great events of the twentieth century. In the course of just two decades, the country has undergone processes of social, economic, and industrial change that in the West spanned centuries. As China gradually becomes integrated into the world economy, the relevance of Western management models becomes a practical matter as much as a theoretical issue (Peng and Heath, 1996; Shenkar and von Glinow, 1994; Tan and Litschert, 1994). Since China differs from Western countries in culture, society, and political and economic systems, it potentially represents the most serious challenge to the managerial paradigm and management theories developed and empirically tested primarily in the West. It thus presents promising grounds to refine and test existing management theories and to develop new ones ones with greater contextual contingency and wider theoretical perspective (Peng and Heath, 1996; Tan and Li, 1996; Shenkar and von Glinow, 1994). [why China]

It is absolutely clear that over the past two decades of reform, the contribution of SOEs to China's total industrial output has declined significantly. In 1978, SOEs accounted for over 75 per cent of the nation's industrial output. By 2000, the portion had dropped to under 28 per cent (State Statistical Bureau, 2001). However, it would be a tremendous error to think that SOEs have been peripheralized. Despite all the changes that have swept China in the last twenty years, heavy industry still remains thoroughly dominated by the state owned or controlled enterprises. No other controlling ownership forms penetrated large-scale capital-intensive industries in any significant sense. SOEs are still providing the basic inputs upon which all other sectors depend on, and for that reason alone can still be considered the 'backbone' of Chinese manufacturing. Overall, as Steinfeld (1998, p.16) suggested, while SOEs are producing a smaller share of China's national industrial output than in the past, that remaining share has become even more concentrated in such core heavy industries as coal mining, petroleum extraction, petrochemical manufacturing, metallurgy, and machine building. Despite the decision at the Fifteenth CCP Congress in 1997 that the state should "let go" of most small and medium-sized SOEs, leaving them to be sold off, merged, or allowed to go bankrupt as the market dictated, the top leadership in China still will remain overall state ownership and state control for large-scale SOEs in heavy industries. [why SOEs]

In broad terms, China's ongoing program of SOE reform has aimed at giving SOEs progressively greater *autonomy* at the firm level from the government especially in the areas of marketing, production and capital investment, while also forcing them to take more *responsibility* for their own profits and losses and to be more responsive to market signals in their business operations. Historically, Chinese managers have little or no involvement in the development of corporate, business, marketing, finance, and manufacturing strategies, whereas now there is an increased recognition that strategic management activities such as these are the very *essence* of management task for managers of manufacturing companies. However, intelligent marketing and competitive strategy formulation are not enough by themselves. The types of manufacturing structures, more specifically infrastructures such as production system, work organizations, and set of production capabilities developed under the command economy are often inappropriate to satisfy the emergent free market. The strategic management of manufacturing within the changing business context in general and the development of effective manufacturing strategies at the firm level in particular, as Forrester and Hassard (2000, p.426) suggest, are therefore essential to achieve the goal of SOEs reform and enterprises' long-term competitiveness. China's entry into the WTO will expose SOEs further to the international competition and make this task even more urgent.

[Strategic management of operations and operational improvement has become a critical issue for the success of SOEs reform and enterprises' long-term competitiveness.]

China's petrochemical industry constitutes a basic heavy industrial sector, which has been always a strategic focus for development by the Chinese government. In 2000, the aggregate GDP of China's petrochemical industry (including petroleum processing and production of organic chemicals, resins and plastics, synthetic rubber, synthetic fibres and chemical fertilisers) accounted for approximately 15.3 per cent of China's aggregate industrial GDP (The PRC Chemical Industry Yearbook, 2001). Entry into the WTO will make China's downstream petrochemical production even more susceptible to competition from foreign participants. Average petrochemical and polymer tariffs, as a result of WTO requirements, will drop from 15% in 2000-01 to 10% in 2005. Lower entry barriers encourage more competition and lower prices. These environmental factors will bring about either an extinction of inefficient state manufacturers or a sustainable improvement in production and operations performance of the industry. However, as Forrester and Hassard (2000) suggested, much of the developmental effort within China's SOEs concentrates upon snapshot technology-led upgrading of production facilities and little attention has been paid to the longer-term strategic development of operations and production competencies. There has emerged a critical need to improve the quality of SOEs' management of business operations following a strategic perspective. [why petrochemical industry]

(ii) Drawing Sample and Case Companies from the Chosen Population

Sampling is crucial for later analysis. As much as you might want to, you cannot study everyone everywhere doing everything. Your choices - whom to look at or talk with, where, when, about what, and why - all place boundaries on the conclusion you can draw, and on how confident you and others feel about them.

In traditional hypothesis-testing studies, researchers *randomly* select the sample from the population. It demands an operational enumeration of the entire universe or pool of potential respondents and then a statistical procedure for selecting the specific subset of respondents to be surveyed. In this type of study, the goal of the sampling process is to obtain accurate statistical evidence on the distributions of variables within the population. This statistical logic is applicable whenever an investigator is interested in determining the prevalence or frequency of a particular phenomenon and when it is too expensive or impractical to survey the entire universe or pool. The resulting data collected from the sample that is actually surveyed are assumed to reflect the entire universe or pool, with inferential statistics used to establish the confidence intervals for which this representation is actually accurate.

As Miles and Huberman (1984), Eisenhardt and Bourgeois (1988), Pettigrew (1988) and Yin (1994) note, qualitative case studies usually work with small samples of people nested in their context and study in-depth - unlike quantitative research that aims for larger numbers of context-stripped cases and seek statistical significance. Sampling for qualitative case studies tends to be *purposive*, rather than random. This tendency is partly because the initial definition of the universe/population is more limited and specific, and partly because social processes have a context-embedded coherence, and an interdependent logic that context-stripped random sampling can reduce them to uninterpretable sawdust. Furthermore, as Yin (1984 and 1994) suggests, with small numbers of cases, random sampling can deal you a decidedly biased hand. Therefore, qualitative case studies, as in this project, follow the logic of 'theoretical sampling' of cases. As Pettigrew (1988) noted, given limited number of cases that can usually be studied, it makes sense to purposefully choose cases in which the social process of interest is "transparently observable". Thus, the goal of theoretical sampling is to choose cases, which are likely to replicate or extend the emergent theory.

From the above perspective of theoretical sampling, this project has chosen Yanshan as the sample from the population of large-scale SOEs in China's petrochemical industry to the following three theoretical criteria:

1. Typical Case of large-scale SOEs

From 1988 to 2000, Yanshan has been consistently ranked the 10 largest SOEs in China based on sales revenue.

2. Critical Case in the industry

Since the first phase project put into operation in 1969, Yanshan has produced more than 160 million tonnes of petrochemical products providing the state with critical energy and raw materials for the modernizations of the industry, agriculture, and national defence. Yanshan is recognized by the State Planning Commission as one of the most critical petrochemical base in China with current 62 sets of production facilities producing 102 kinds with 227 grades of petrochemical products, processing 9.5 million MTA of crude oil and 660,000 MTA of ethylene. At the beginning of 1997 Yanshan as one of the SINOPEC wholly owned subsidiaries was chosen as GCS reform pilot and undertaking internal MES reform experiments. According to the

preliminary results assessment by NPC and SETC at year 2000, the piloting group-company system reorganization and corporate share-holding system reform at Yanshan has generally been successful. The financial performance of the company has well demonstrated the test run in succession.

Because Yanshan has consistently operated and performed well ever since it first established, many government officials both at Beijing Municipal level and Central Government level were previously managers of the company. Therefore, in recognition of leading Chinese scholars Yanshan is a particularly noteworthy case for studying the management reform and operations management of China's SOEs, and the research finding from such study could permit logical generalization and maximum application of information to other cases in the population.

3. Successful case in strategic management of business operations

The *strategic success* of Yanshan's business operations in general and its manufacturing management in particular, in fact, has been the most important criteria for choosing the company as the sample from the population. Yanshan has achieved *long-term competitiveness* in the domestic marketplace and established and sustained leadership position among domestic producers in the industry of which, as stated at the outset of the thesis, is the ultimate goal of strategic management of business operations.

Although one could always argue especially in the case of China's SOEs, numerous contextual variables influence a firm's operational performance such as policy and regulations of the industry, its political relationship and connection with the local and central government agency. Economic and political factors have, as Hassard, Sheehan, and Morris (1999) suggest, significantly influenced firms' performance during the Contract Responsibility System (CRS) period of SOEs reform. At that time, since the lack of a standard contract of transparent and definite regulations governing profit remittance, the process of quota setting relied so much on bilateral negotiation, politically well-connected enterprises were able to use these connections to their advantage. However, the recent emphasis on "corporatization" of SOEs, including the GCS/MES reform and formation of shareholding and limited-liability companies, has moved SOEs' business operations an important step further toward eventual *market*

mechanisms. Given all these, China's SOEs within a given industry currently, in fact, share more *equal* economic and political context than they previously did. For example, in China's petrochemical industry, SINOPEC, which has controlling interests authorized by the government in most of large-scale state petrochemical enterprises that are major competitors in the domestic market, has confirmed in writing its equal treatment undertaking among all its controlled subsidiaries. Furthermore, given the enforced reform measures from the government, most of SOEs within the industry share the same overall organizational structure, share access to the same process technology, production systems, and infrastructure elements. However, these firms are not *equally* successful in achieving long-term competitiveness of the business. Therefore, given the above, one could argue that SOEs' internal operations management emerges to contribute a key role in determining the long-term competitive performance of the firm, more specially the quality of strategic management of business operations as it does for their counterparts in the Western economies.

It has long been widely recognized by Western strategy literature that strategic management of business operations is the essential mediating force between the firm and its operating context and the *ultimate determinant* of firm's long-term competitiveness in the marketplace (Mintzberg, 1979, p.25). In other word, as Miller (1988, p.288) suggest, simple presence of either a certain environment (external context) or organizational conditions (internal context) of the business will not result in firm's "strategic success" without an appropriate strategy in place. This is not to say that contextual factors such as general economic trends, changes in demographic structure, or social and political context are unimportant to firm's long-term competitiveness. These factors may also be critical determinants of the threats and opportunities a company will face in the future and therefore influence firm long-term competitiveness. However, they do not in themselves determine and result in firm's long-term competitiveness. As Grant (1991) suggests, the *key* issue is how these contextual factors impact the firm's management of business operation especially in a strategic sense.

The role of the production system as a determinant of competitive performance of the firm has long been the subject of industrial organization research, even predating the explicit conceptualisation of manufacturing strategy in the literature. Needless to say, the role of a firm's production system is expected to continue to exert strong influence

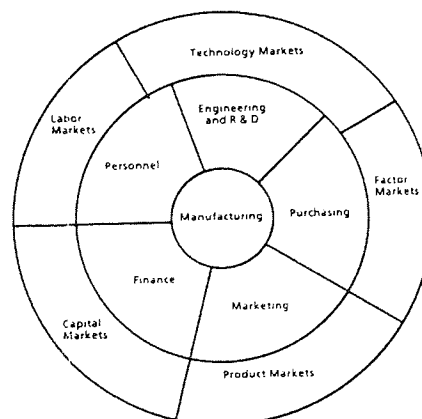
on the long-term competitiveness of the firm. In addition, emerging production issues dealing with the globalization of production, global supply chain management, e-commerce and e-business, integrated product and process development, and mass customization are challenging issues that are expected to critically influence the 'strategic success' of a firm. A number of authors have argued that functional strategy in general and manufacturing strategy in particular describes and reflects firm's strategic management of business operations by providing a more detailed picture of how management's strategic perspective is pursued in decision-making in relation to the embedded operating context over time (Hatten et al., 1978; Miller, 1987). In perceptual term, it has been revealed through the pre-research investigation by top management at Yanshan that manufacturing has been contributing as one of the pillars of Yanshan's achieved long-term competitiveness in the marketplace. In substantive term, the production system at Yanshan has achieved and sustained distinctive competence in terms of cost control, quality improvement, fast and dependable delivery, and flexible adjustment in production schedule and volume. Detailed discussion on performance measurement applied in this study is presented in Chapter 4. Yanshan's strategic success in manufacturing management is to be presented in details in Chapter 6.

After presenting the "sampling logic" and "sampling process", the question of just which cases to include in the sample is discussed below. Both the literature and the pre-research field investigation have identified that the development of manufacturing strategy primarily occurs at SBU level of the firm. Five SBU divisions in the core petrochemical business of Yanshan - Ethylene Division, Polypropylene Division, Polyester Division, Basic Chemical Division, and Synthetic Rubber Division, were chosen as case companies in this study in which the development of manufacturing strategy is independent event occurred in each of them. However, given the fact that corporate, business, and functional hierarchy, each level has a distinct and important role to play in achieving competitive advantage, and the firm's manufacturing strategy is designed at all three levels (see Schroeder et al., 1986; Hayes and Wheelwright, 1984). The author has also included role partners at corporate level in order to provide a holistic picture of the development of manufacturing strategy at the case companies.

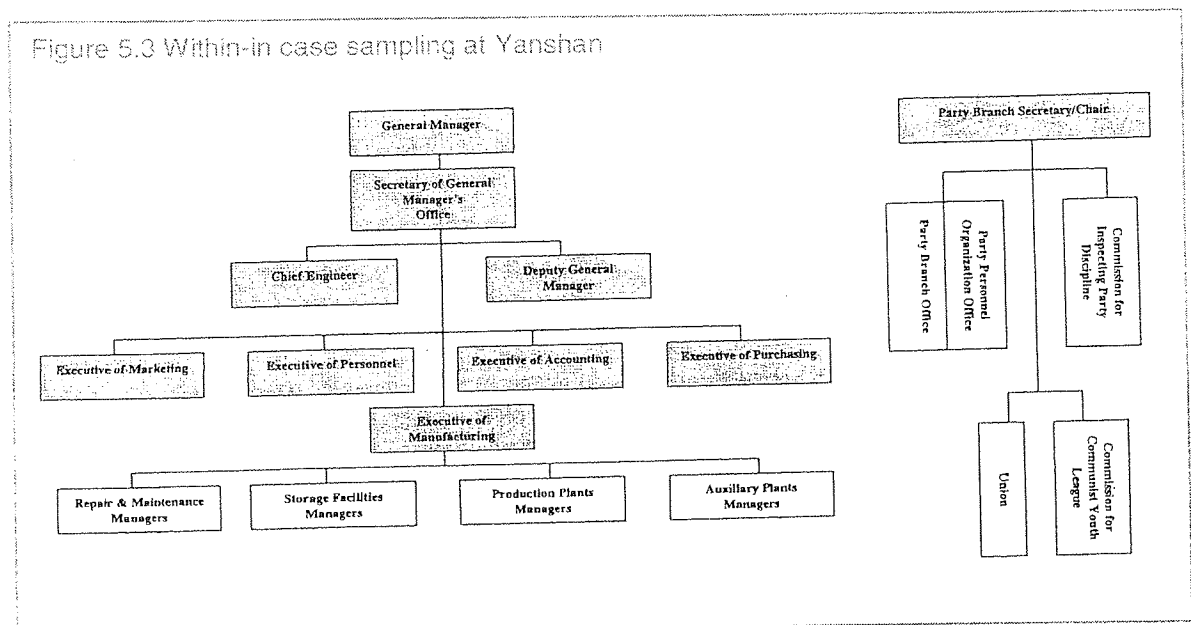
(iii) Within-case Sampling

This section will present the discussion on within-case sampling decisions. First major point, as Miles and Huberman (1984) suggest, is that such sampling must be theoretically driven. In this project, choices of role partners, respondents, and interactions for empirical investigation are driven by the theoretical foundations for the research presented in Chapter 1. The framework of sampling applied here is Fine and Hax (1985)'s model of integrating manufacturing decision-making into firm's strategic context, which is demonstrated earlier by Figure 3.1 in Chapter 3. Fine and Hax (1985) advocate a multifunctional interface for developing manufacturing strategy rather than the unitary manufacturing-marketing interface proposed by the Skinnerian paradigm. First, in developing manufacturing strategy, management decision-making must work with finance, marketing, engineering and R&D, personnel, and purchasing, by which it builds upon as internal inputs. Second, the process of developing manufacturing strategy must be based on carefully monitoring of firm's environmental context by manufacturing along with the other functional areas, which are its external inputs (i.e. markets and industry). Therefore, for both internal and external inputs to the development of manufacturing strategy, other functions of the business are important role partners and related interactions have to be subject to the study. Of special note the logic of sampling here is not by a concern for "representativeness". To get in-depth into each major constructs of the research, investigations need to see different instances of it, at different moments, in different places, with different people. In short, the primary concern is with the conditions under which these major constructs of manufacturing strategy process operate.

Figure 5.2 Integrating manufacturing decision-making into firm's strategic context (as Figure 3.1)



The second major point, as Yin (1981) suggests, is that within-case sampling has an iterative or "rolling" quality, working in progressive "waves" as the study progresses. In this project, within-case sampling is investigative. The author started with essential respondents and interactions addressed by the above sampling model. While interviewing, observing, and picking up documents, empirical evidence leads investigation to new respondents, observations, and new documents needed to be included for deeper locally grounded explorations. So sampling in this way helps researcher see a contextual configuration in more 'depth'. However, the within-case sampling framework is finalized after the pilot case study and details set out by the following chart:



5. 3. Data Collection and Case Study Protocol

As Yin (1994, p.63) suggests, case study protocol should contain 'sources of empirical evidence' from which data would be collected and 'instrumentation of ways and procedures' with which data would be collected, but also should contain 'general rules' that would be followed in the process of data collection.

Because of the *aim* and *focus* of this project and its *exploratory nature*, as Miles and Huberman (1984) noted, highly structured instrumentations or close-ended devices are inappropriate for empirical study. Highly structured and close-ended instrumentation is usually context-stripped and blinds the researcher to the site. However, as discussed earlier, the goal of the research is to provide freshness to the existing paradigm of manufacturing strategy development. Given the critical and influential role of prior literature identified in previous chapter, the serious unitary and contextual bias in the existing paradigm manufacturing strategy development up to date requires the author to formulate the theoretical perspective and design with an 'integrative perspective' by which the deliberate and emergent aspects of strategy development practice could be synthesized together for conceptualising the context-embedded paradigm of manufacturing strategy development. The multiple-case design of the study also requires some standardization of instrumentations so that finding can be laid side by side in the course of comparative analysis and analytical generalization. In short, for the above two reasons, protocol has to be planned and prepared but what is planned has been deliberately half-scripted or semi-structured essentially serving as guidelines for the researcher. The subsequent operations and applications in the field therefore have been sufficiently open and largely improvised by the author for the possible best exploration of the context-embedded configuration of the phenomenon.

5. 3. 1. Major Sources of Evidence and Instrumentations for Collecting Data

Data collection for case studies can rely on six major sources of evidence: interviews, direct observations, participant-observations, documentations, archival records, and physical artefacts (Schatzman and Strauss, 1973; Murphy, 1980; Webb et al, 1981; Yin, 1984). In this project, four of the above major sources of evidence have been used in the research. This section will present discussions on these multiple data sources and ways of collecting them. However, before goes into each type of source and way of collecting data, of special note is the overall strength of qualitative evidence in studying the subject of the research.

In the earlier section upon the aim, focus, and central issue of this project, qualitative evidence has been identified as the primary data source of the empirical studies. One major feature of qualitative evidence is that it focuses on naturally occurring, ordinary events in natural settings, so that one could have a strong handle on what are actually involved in the "real life" process of the organization and of what kind of manners the "real life" process is organized and unfolded. That confidence is buttressed by local groundedness, the fact that the data from qualitative evidence were collected in close proximity to a specific situation, rather than through the mail or over the phone. The emphasis is on a specific case, a focused and bounded phenomenon embedded in its context. The influences of the local context are not stripped away, but are taken into account. Another feature of qualitative evidence is its richness and holism, with strong potential for revealing nested complexity of interactive and interdependent processes of the organization. Furthermore, the fact that such data are typically collected over a sustained period makes them powerful for studying any organizational process by going far beyond "snapshots" to going in-depth of "how" things happens as they do. And qualitative evidence, with their emphasis on people's "lived experience," is fundamentally well suited for locating the meanings people place on the events and processes of their lives: their perceptions and interpretation, and for connecting these meanings to the social world around them (van Manen, 1983).

(i) Qualitative Semi-structured Interviews

Overall, interviews are an essential source of case study evidence because most case studies are about human affairs as in this research. These human affairs should be reported and interpreted through the eyes of specific interviewees, and well-informed respondents can provide important insights into a situation. They also can provide shortcuts to the prior history

of the situation, helping you to identify other relevant sources of corroboratory evidence - and initiate the access to such sources. As Kvale (1983, p.174) defines the qualitative interviews as 'an interview, whose purpose is to gather descriptions of the life-world of the interviewee with respect to interpretation of the meaning of the studied phenomenon.' He adds that 'neither in the interview phase nor in the later analysis is the purpose primarily to obtain *quantifiable responses* (Kvale, 1983, p.175). The goal of any qualitative research interview is therefore to see the subject of studies from the perspective of the interviewee, and to understand the internal logic of interviewee's interpretation under the given context. The qualitative research interview is most appropriate, as Kvale (1983) suggests:

1. Where a study focuses on the meaning of particular phenomena to the participants.
2. Where common perceptions of processes within a social unit are to be studied prospectively, using a series of interviews.
3. Where historical accounts are required of how a particular phenomenon developed.

The above characteristics of qualitative interview make it fundamentally well suited to study the subject of this research.

Qualitative interviews conducted in the research are of open-ended nature, in which the author asked respondents for the facts of specific situations and action sequences as well as for respondents' perceptions and understandings about events. They are not based on a formal schedule of questions to be asked word-for-word in a set order. Instead they use a semi-structured interview guide, list of facets or topics, which the author attempted to cover in the course of the interview. The author was closely familiar with the guide, but had latitude to use a personally congenial way of asking and sequencing the questions, and to segment them appropriately for different respondents. In fact, as Miles and Huberman (1984) suggest, *flexibility* is the single most important factor in the qualitative interviewing. A common set of opening questions have been used to start all interviews in the research, but beyond that facets or topics have not been addressed in the order in which they appear in the interview guide, or in any other predetermined sequence. As interviewer, the author allowed them to be raised by the interviewee or introduce them at points where they fit naturally into the course of interview. In the ending phase of the interview, the author gave all interviewees the opportunity to make any comments about the subject at hand, which has not been covered in the rest of the interview. The development of interview guide does not end at the stage of

case study protocol design. It has been further modified through the use in pilot case study in which the empirical-based refinement has further focused the scope of the interview and developed the pathway between interview questions and corroboratory evidence from other sources. The following is the final version of semi-structured interview guide used in the empirical investigations of the research.

Interview Guide	
Opening Phase	Corroboratory Evidence
<u>Brief introduction to the research project</u>	
<ul style="list-style-type: none"> • Present Aston Business School Covering Letter and Letter of Support from Yanshan for the project • Explain the scope, goal, and objectives of the research 	
Interview begins by taking the interviewee back to the time just before Share Holding System restructuring at Yanshan.	
1. When did the management of this firm start to engage with the development of manufacturing strategy?	Documentations
	Pre-research investigation
2. How was the development of manufacturing strategy managed before the MES reform and Share Holding System restructuring at Yanshan?	Documentations
Main Body	
<u>Context Dimension</u>	
3. Could you please describe the contemporary business environment of the firm and major changes occurred in it since the MES reform with respect to:	

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| - change in customer requirements, production/service technologies, industrial policies/government regulations, and modes of competition in firm's principal industry (environmental dynamism) ? | Documentations
Archival records |
| - differences in competitive tactics, customer requirements, product lines, channels of distribution, etc. across the firm's respective markets. (environmental heterogeneity)? | Documentations
Archival records |
| - price, product, technological and distribution competition, severe regulatory restrictions, shortages of labour or raw materials, and unfavourable demographic trends (environmental hostility)? | Documentations
Archival records |

4. Could you please describe firm's current **organizational structure and power system** and major changes occurred in them since the MES reform with respect to:

- | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| - the distribution of decision-making power down the hierarchy of authority to line managers or dispersed out of the line hierarchy to technostructure/supports staff (delegation)? | Documentations |
| - the using of formalized rules, procedures, standards, and precedents in management control such as cost controls, quality controls, capital budgeting, information management, performance assessment, and personnel appraisals (bureaucratization)? | Documentations |
| - the deployment of professional specialists in organizational control such as engineers, scientists, and functional expertises (specialization)? | Documentations
Archival records |
| - the use of task forces and cross-functional committees to assure compatibility among decisions in one area with those in other areas (liaison devices)? | Documentations
Direct observation |

5. Could you please describe firm's **business resources and organizational capabilities** and major changes occurred in them since the MES reform with respect to:

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| - total asset purchased by the firm (Tangible Resource)? | Archival records |
| - firm's direct relationship with buyers, suppliers, competitors, government agencies, and firm's reputation among other parties in the principal industry (Relational resource)? | Documentations |
| - set of unique knowledge, capability, and attitude that enables the firm to achieve the competitive edge in its respective area of business operations (Competence)? | Documentations |

6. Could you please describe firm's **business competitive strategy** with respect to:

- | | |
|----------------------------------------------------------------------------------------------|-------------------------|
| - how is cost control managed (i.e. production cost, operating expenses, and overheads etc)? | |
| - how is product innovation and R&D managed? | Documentations |
| - what is marketing emphasis and expense? | Archival records |
| - what is product-market scope? | |
| - how does asset management carry out? | |

Content Dimension

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| 7. What is the role of manufacturing in contributing to the competitive success of the firm? | Documentations |
| 8. What are the competitive priorities of manufacturing regarded by the firm: | Documentations |
| <ul style="list-style-type: none"> - cost? - quality? - delivery performance? - flexibility? - others? | |
| 9. What are the key strategic manufacturing decisions regarded by the firm in building prioritised competitive manufacturing capabilities: | Documentations |
| <ul style="list-style-type: none"> - process technology? | |

- capability, facility, and vertical integration?
- quality systems?
- production and inventory control?
- workforce management?
- manufacturing organization?

The above questions on context and content dimensions will establish a context-embedded platform for investigations on the process dimension of manufacturing strategy development.

Process Dimension

How are the above competitive priorities of manufacturing determined and further translated into the set of strategic manufacturing decisions over time with respect to:

Organizational involvement

- | | |
|----------------------------------------------------------------------------|-----------------------|
| 1. Could you please describe the functional areas involved in the process? | Documentations |
|----------------------------------------------------------------------------|-----------------------|

Information Flow

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 2. Could you please describe the managerial perceptions of critical information input from those <i>functional areas</i> involved to the development of manufacturing strategy? | Documentations |
| 3. Could you please describe the managerial perceptions of critical information input from <i>top-management of the firm</i> to the development of manufacturing strategy? | Documentations
Direct observation |
| 4. Could you please describe the managerial perceptions of the patterns of information flow involved in the development of manufacturing strategy? | Documentations
Direct observation |

Managerial Leadership

5. Could you please describe the role of corporate staff in the process of manufacturing strategy development?
6. Could you please describe the role of top-management in the process of manufacturing strategy development?
7. Could you please describe the role of the manufacturing executive in the process of manufacturing strategy development?
8. Could you please describe the role of the manufacturing executive played in the business strategy process? **Direct observation**
9. Could you please describe your perception on the distribution of decision-making power with respect to the development of manufacturing strategy?

Formalization and Communication

10. Could you please describe the degree to which manufacturing strategy is documented? **Documentations**
11. Could you please describe the degree to which manufacturing strategy is communicated within and beyond the boundary of production system? **Documentations**

Planning Anchors and Decision Aids

12. Could you please describe the extent to which the development of manufacturing strategy is tied to the annual budgeting process? **Documentations**
Archival records

13. Could you please describe the extent to which the development of manufacturing strategy is tied to analytic and systematic techniques and procedures? **Documentations**
Archival records

Performance assessment and Reward Systems

14. Could you please describe how performance assessment is carried out for manufacturing? **Documentations**
15. Could you please describe its tie into the reward systems? **Documentations**

Closing Phase

16. Could you please describe your perception of the success of a manufacturing strategy process?
17. Could you please describe your perception of the major outputs of a successful manufacturing strategy process?
18. Could you please describe your perception of the major determinants of how the manufacturing strategy development would be organized?

Interview questions, as Yin (1994, p.69) suggests, reflect the actual inquiry of the research and are the heart of the case study protocol. However, as he noted, these interview questions are posed to the investigator, not to a respondent. They, in essence, are the reminders of the author regarding the information that needs to be collected.

A key feature of these qualitative interviews conducted in the research is the nature of the relationship between interviewer and interviewee. In a quantitative study using structured interviews, the interviewee is seen as a research 'subject' in much the same way as he or she would if completing a questionnaire or taking part in an experiment. The researcher's concern is to obtain accurate information from the interviewee, untainted by relationship factors. The interviewer therefore tries to minimize the impact of interpersonal process on the course of the interview. In contrast the qualitative researcher believes that there can be no such thing as a 'relationship-free' interview. Indeed the relationship is part of the research process, not a distraction from it. The interviewee in this project was seen by author as a 'participant' in the research, actively shaping the course of the interview rather than passively responding to the interviewer's pre-set questions. The interview as a whole has been carried out as a "collaborated" act on the part of both parties, a joint production, not a gathering of information by one party. The more that a respondent assists in this latter manner, the more that the role may be considered one of an 'informant' rather than a respondent. Key informants are often critical to the success of a case study (Yin, 1984 and 1994). Such persons not only provide the case study investigator with insights into the event but also can suggest sources of corroboratory evidence - and initiate the access to such sources. However, as Kvale (1983) noted, as the prerequisite for having an informant the investigator has to have respondent actively participated rather than passively responded to the interview.

A common question about recording interviews has to do with the use of 'tape recorder'. Whether to use such device is in part a matter of personal preference. The tapes certainly provide a more accurate rendition of any interview than any other method. However, tape recording is not a substitute for "listening" closely throughout the course of an interview and a tape recorder has not been used when an interviewee refused permission or appeared uncomfortable in its presence. If tape-recording was impossible, the author instead made brief memory-jogging notes during the interview and reconstruct as much as possible immediately afterwards. In order to make the interview notes as useful as possible, the author wrote down whatever impressions occurred at the moment, that is, to react rather than to sift out what may seem important, because it is often difficult to know what would and would not be useful in the future.

(ii) Direct Observation

By making a field visit to the case study "site" the opportunity for direct observations has been created. Because the phenomena under investigation have not been purely historical, some relevant behaviours or environmental conditions are ongoing events and available for observation. The observation has included from *formal* to *casual* data collection activities. This has involved observation of company's quarterly strategy review meetings, its factory work which was formally arranged. Less formally, direct observation has been made throughout a field visit including those occasions during which other evidence, such as that from interviews, was collected. For instance, the condition of buildings or work places have indicated something about the climate or improvement of the company; similarly, the location or the furnishings of a interviewee's office has been always one significant indicator of the status of the person within the company specially in China's context.

(iii) Documentations

For case studies of the research, the most important use of documentations is to corroborate and augment evidence from other sources especially from interviews.

First, documents have been helpful in verifying the correct spellings and titles or names of companies and organizations that have been mentioned in an interview. Second, documents provided other specific details to corroborate information from other sources. If the documentary evidence is contradictory rather than corroboratory, the author has specific reason to inquire further into the topic. Third, inferences have been made from documents. For example, in doing case studies, by observing the distribution list for a specific document, the author has found interesting issues about communications and networking within the company. However, these inferences have been treated only as corroboratory information or as clues worthy of further investigation rather than as definitive findings.

Because of their overall value, documents have played an explicit role in data collection in case studies of the research. During the case studies, the author allotted time for using local libraries and company's reference centre. Systematic search of relevant documents is

important in the design of case study protocol. The documentary survey and analysis in the research focused on the following categories:

1. MES reform and Share Holding System restructuring policies and regulations

The sources of reform policies and regulations come from government publications, newspapers, periodicals, etc. These policies and regulations displayed a general outline of the MES reform and Share Holding System restructuring and indicators of legislating decentralisation for enterprises, or re-centralizing control over enterprises. The concern with such reform policies and regulations were (1) significant ones, which marked the progress of MES reform schemes; (2) important ones, which were further used by local authorities and enterprise management to draw their own precise or specific regulations; (3) those referred by interviews as factors influencing strategic manufacturing management.

2. Company background documents

Historical literature, public reports, and media news of the case companies

3. Administrative documents

Proposals, progress reports, agendas, memorandum and minutes of meetings, company letters and internal circulars, and other written reports of managerial events

4. Special documents

Policies, regulations, files and memos within the vertical administrative hierarchy of the case companies

(iv) Archival Records

- Survey data:

The PRC Chemical Industry Yearbook, Import-Export Information of Products of the Chemical Industry, The PRC Chemical Production Information, The PRC Petrochemical Industry Statistical Annual Report, SINOPEC Economic Information.

- Business records:

Business Statistical Yearbook of Yanshan and subsidiaries' sales and production record.

- Organizational records:

Organizational charts and budgets

- Maps and charts:

Geographic characteristics of the company's location, production layout, and distribution network

5. 3. 2. Two Principles of the Data Collection Process

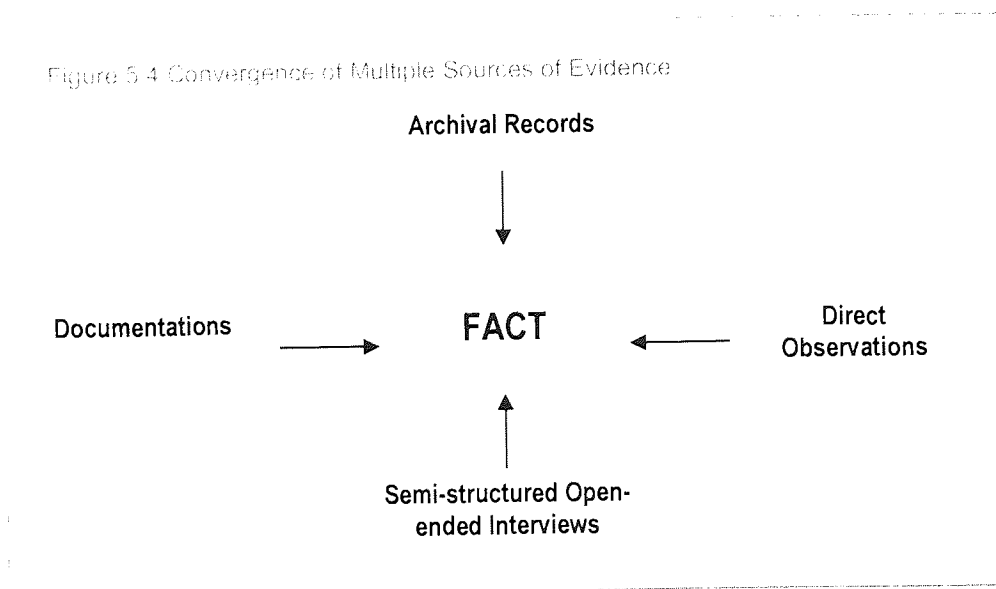
(i) Triangulation

Triangulation is broadly defined by Denzin (1978, p.291) as "the combination of methodologies in the study of the same phenomenon." In the social and organizational sciences, the use of triangulation can be traced back to Campbell and Fiske (1959) who developed the idea of "multiple operationism." They argued that more than one method should be used in the validation process to ensure that variance reflected that of the trait and not of the method. Thus, the most important advantage presented by applying triangulation is the development of converging lines of inquiry, a process of collecting and analysing data following a corroboratory mode.

Jick (1979) suggests three types of triangulation in doing case study - that is, the triangulation:

1. of multiple sources of evidence and ways for collecting them,
2. of multiple investigators, and
3. of multiple perspectives on the same data set.

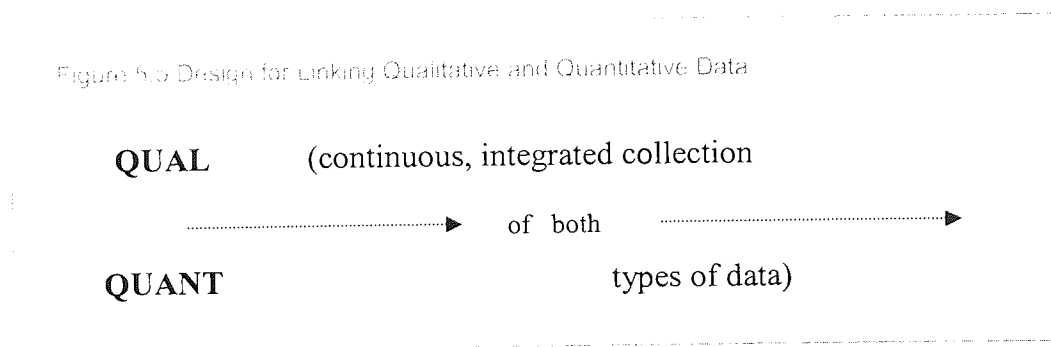
Triangulation of multiple sources of evidence and ways for collecting them applied in this study sets out by Figure 5.4



Of special note to the convergence of multiple sources of evidence is the combing of qualitative with quantitative evidence. Rossman and Wilson (1984) suggest three broad reasons for this: (a) to enable confirmation or corroboration of each other via triangulation; (b) to elaborate or develop analysis, providing richer detail; and (c) to initiate new lines of thinking through attention to surprises or paradoxes, "turning ideas around," providing fresh insight.

Quantitative evidence has helped with the qualitative side of a study during research design by finding a representative sample and locating deviant cases. It helped during data collection by supplying background data, getting overlooked information, and helping avoid "elite bias". During data analysis quantitative data helped via showing the generality of specific observations, and verifying or casting new light on qualitative findings. Looking at the other way, qualitative data has helped the quantitative side of a study during research design by adding with conceptual development and instrumentation. It helped during data collection by making access and data collection easier. During analysis it helped by validating, interpreting, clarifying, and illustrating quantitative findings.

In this study, the fieldwork has involved steady, integrated collection of both quantitative and qualitative data, as required for the best exploration of a holistic context-embedded fact of management paradigm of manufacturing strategy development at the case companies (see Figure 5.5). Only when all of the evidence has produced a consistent picture was the author satisfied that the particular strategy development practice studied has actually occurred in a certain manner discovered.



Triangulation of multiple investigators, as Pettigrew (1988) suggests, has two key advantages. First, they enhance the creative potential of the study. Team members often have complementary insights which add to the richness of the data, and their different perspectives increase the likelihood of capitalizing on any novel insights which may be in the

data. Second, the convergence of observations from multiple investigators enhances confidence in the research finding. The strategy applied in this study for employing multiple investigators was to make the visits to the case study sites in teams. During the second phase of data collection in April 2000, the author conducted the fieldwork at Yanshan together with his doctoral supervisor - Dr. Paul Forrester. This not only provided the author with tremendous work-in-progress guideline and advice but also allowed the case to be viewed from different perspectives of multiple observers. A further tactic following this strategy was to give the individuals on the team unique roles to play during the fieldwork, which increases the chance that investigators will view case evidence in divergent ways. For example, interviews conducted by both the author and Dr. Paul Forrester, with Dr. Paul Forrester handing the interview questions, while the author records notes and observations.

Triangulation of theoretical perspectives has been presented in detail in Chapter 4. In short, given the critical and influential role of prior literature identified in previous chapter, the serious unitary bias from a theoretical perspective in the existing paradigm of manufacturing strategy development requires the author to formulate the framework of analysis with an 'integrative' perspective by which the deliberate and emergent aspects of strategy development practice could be synthesized together. Following this integrative theoretical perspective, the author attempts to reconcile evidence across cases, types of data, and different investigators, and between cases and literature increase the likelihood of creative reframing into a new theoretical vision.

As Yin (1994, p.34) suggests, the rationale of triangulation is an important tactic to overcome researcher's bias and increase construct validity, which will be discussed in details in the later section.

(ii) Overlapping Data Collection and Data Analysis

A striking feature of theory-building case studies is the frequent overlap of data analysis with data collection. Overlapping data analysis with data collection not only gives the researchers a head start in analysis but also, more importantly, allows researchers to take advantage of 'flexible data collection'. In fact, a *key feature* of theory-building case research is the freedom to make adjustments during the data collection process. For example in this study, adjustment has been made to data collection instruments, such as addition of questions to the interview guide. These adjustments allow the author to probe emergent themes or to take

advantage of special opportunities, which may be present in a given situation. For example, the author added important observational evidence when the opportunity to attend quarterly strategy review meeting arose. The central idea of overlapping data collection and data analysis, as Sutton and Callahan (1987) suggest, is that the theory-building process could be intimately tied with evidence - iterating toward a theory which closely fits the data, which make the research takes advantage of new insights possible from the data and yields an empirically valid generalization.

Case study notes, as Eisenhardt and Bourgeois (1988), and Yin (1994) suggest, are important means of accomplishing this overlap. Case Study notes in the research have taken a variety of forms. In this study, the notes have been a result of the author's interviews, observations, or document and archival records analysis. Most of these notes have been handwritten and assembled in the form of a case study diary of each site and summarized by a single sheet "**contact summary form**" that is to be presented in chapter 6. However, as Yin (1994, p.96) suggests, this identification of the case study notes as an important means for overlapping data collection and data analysis does not mean that the researcher needs to spend excessive amounts of time in writing interviews or making extensive editorial changes to make the case study notes presentable. Any such editing effort should be, as he suggests, directed at the case study report itself. The only essential characteristics of the case study notes are that they should be organized, categorized, complete, and available for later access and analysis.

The above two principles of data collection process have been major steps in the direction to ensure the 'quality' of research design. They are intended to make the process as explicit as possible, so that the final result - data that have been collected - reflect a concern for *construct validity* and for *reliability*, thereby becoming worthy of further analysis.

5. 3. 3. Pilot Case Study

The final stage of research design is the conduct of a pilot case study. The pilot case study not only helps the author to refine case study protocol with respect to both the content of the data and field procedures to be followed. It has been used more formatively, assisting the author to develop relevant lines of questions, the pathway between questions and corroboratory evidence from other sources, and providing some conceptual clarification for multiple-case design applied (see chapter 1 Chart of Multiple-case Design).

Data from pilot case study has provided considerable insight into the basic issues being studied. This information was used in parallel with an ongoing review of the relevant literature, so that the final research design was informed both by prevailing themes in the literature and by a fresh set of empirical observations. The dual sources of information help to ensure that the study to be done reflected significant theoretical issues as well as empirical questions relevant to contemporary cases.

The selection of pilot case in this study has been addressed with an essential concern for access, convenience and geographic proximity. Beijing Yanhua Hi-Tech Co., Ltd. has been chosen as the pilot case for the above reasons. The company is one of Yanshan's controlled subsidiaries in the diversified petrochemical business. It has been restructured and formed into joint share holding company in later 1998 and has been listed on Shengzhen stock exchange in succession in 1999. It shares the same shareholding and administration structure, as do the five case companies of the study.

5. 4. Data Analysis and Coding Process

Analysing data is the heart of theory building from case studies. The conceptual perspective of data analysis applied in this research is interpretivism. Interpretivism, as Ditley (1911/1971)'s thesis suggests, argues that human discourse and action could not be analysed with the methods of natural and physical science. Human activity was seen by interpretivism as "text" - a collection of symbols expressing layers of meaning. For social interpretivist, interpretation comes via the understanding of group actions and interactions. In both cases there is an inevitable "interpretation" of meaning made both by the social actors and by the researcher.

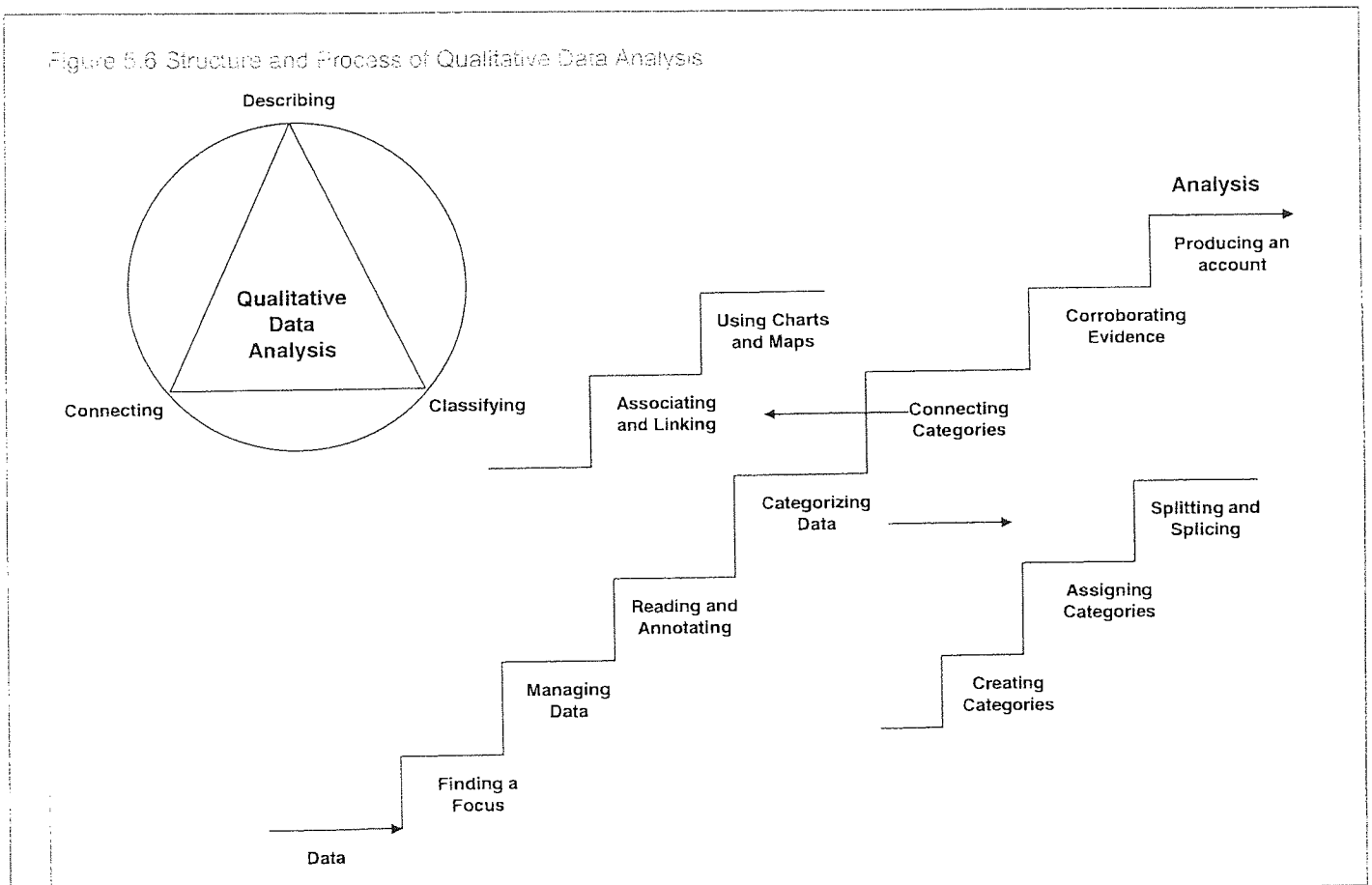
From the above conceptual perspective, as Miles and Huberman (1984, p.56) suggest, coding - to view a set of field notes, transcribed or synthesized, and dissect meaningfully, while keeping the relations between the parts intact, is the stuff of data analysis. Of special note, it is not the words themselves but their meaning that matters.

In the last five years, there has been something of revolution in coding techniques. A range of computer packages aimed at assisting qualitative text coding have appeared on the market, and a growing number of social scientists are using them. The best known and most widely used is NUDIST and QualPro. Typically, computerized aids to qualitative text coding offer the researcher the chance to carry out sophisticated and rapid searches through textual data, which has been entered from a word-processing package such as Word Star or Word Perfect. Despite many advantages, there are some 'drawbacks' and potential 'pitfalls' in the use of computerized textual coding. The greatest danger is that researchers may have to design their studies and analysis techniques on the basis of what the programme they happen to own can best handle. For this study, there has not been any programme on the market so far can process Chinese language sufficiently. From many previous experiences (Shenkar and von Glinow, 1994; Tan and Litschert, 1994; Tan and Li, 1996), a great deal of weight in the data could be lost during the *translation process* from Chinese to English at the stage of 'transcription'. Therefore, the author worked with case study notes transcribed in Chinese language and applied manual coding. The author annotated and colour-coded transcripts, used 'cut-and paste' techniques to gather information on themes across transcripts.

How researchers get from the collecting of data to their interpretation and conclusions is the part of case study research, which is **least** well described in the existing methodology

literature. However, some leading scholars in the field have been trying to provide more details of the methods they use in analysing qualitative data employing primarily inductive techniques (Eisenhardt, 1989; Glaser and Strauss, 1967; Marshall, 1981; Strauss and Corbin, 1990; Yin, 1989). There is widespread agreement that high quality qualitative data analysis needs to make use of coding techniques to classify or categorise groups of words. As discussed earlier, data analysis and data collection are developed together in an iterative process during the research. As noted, this can be a strength as it allows for theory development which is grounded in empirical evidence and therefore to address the concern for increasing the validity of empirical generalization. In view of this feature of the research the author has found it very fruitful to follow Dey's (1993) advice in the structure and process of qualitative data analysis (see Figure 5.6)

Figure 5.6 Structure and Process of Qualitative Data Analysis



Qualitative data analysis, as Dey suggests, is a circular process of describing the phenomenon under investigation, classifying them, and seeing how emerging concepts interconnect. This has been well reflected by the interactive process of data collection and analysis in which description lays the basis for analysis, but analysis also lays the basis for further description. Through ongoing analysis, the author can always obtain a fresh view of the data and progress from initial description, through the process of breaking data down into

bits, and seeing how these bits interconnect, to a new account based on the ongoing reconceptualization of the data. The author breaks down the data in order to classify it, and the concepts the author created or employed in classifying the data, and the connections the author made between these concepts, provide the basis of a fresh description.

➤ **Developing in-depth and holistic descriptions of the phenomenon**

The first step in data analysis is to develop thorough and comprehensive descriptions of the phenomenon under investigation. This involves the preparation of interview transcriptions and the writing-up of case study notes for each of the five case companies. In contrast to the descriptions developed for the group and corporate level of Yanshan which mainly state 'facts', descriptions developed for the firm level also include about the context of an act, the intentions and meanings that organization action, and its subsequent evolution during the period of MES reform. A mistake the author first made during writing-up of case study notes was to believe that the narrative is the most interesting aspect of the study. However, through the interaction with other role partners and fellow researchers, narrative alone is unlikely to be interest to those outside the organization and every effort has to be made to draw out the wider implications of the study while giving a strong sense of the particular circumstance of the case. The author have found that a first draft of case study notes may often follow narrative more than the wider themes, as this helps the researcher get 'the storyline' straight. In the second draft, the author then can move on to the broader implications of the study. Of special note, the author found sometimes a brief description of the main event in transition, as appears in the Chapter 6 in a tabulated form, can help get past the need to set the events chronologically while also wanting to pursue themes in the case.

➤ **Within-case Analysis: developing categories and organizing data**

Within-case analysis refers to the minute examination and conceptual interpretation, a process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up interview transcriptions or case study notes developed in the previous stage. It is a form of coding analysis that sharpens, sorts, focuses, discards and organizes data in such a way that "final" conclusions can be drawn and verified. In fact, as Glaser and Strauss

(1967) suggest, it includes both open and axial coding. Grouping data in this way therefore involves developing a set of criteria in terms of which to distinguish observation as similar or related. This has been done through the development of a set of categories, with each category expressing a criterion (or a set of criteria) for distinguishing some observations from others. For example, six such categories have been developed and applied for organizing observations regarding the process of manufacturing strategy development (see Chapter 4 section 4.3.1 and Chapter 6 section 6.6.5). The development of a set of categories allows the data to be organized through a variety of different perspectives.

In categorizing data, the author is not simply bringing together observations, which are similar or related. A comparison is implied in the adoption of a particular category. This follows that within-case analysis obliges the researcher to examine and interpret the specifics of data not only details in a descriptive sense but also in the analytic sense. The data is being classified as 'belonging' to a particular group and this already implies a comparison between this data and other observations, which do not 'belong' to the category in question. That is making comparisons along the level of properties and dimensions and in ways that allow the analysis to break the data apart and reconstruct them to form a conceptual interpretation. This process allows the unique patterns of each case to emerge before the author moves on to generalize patterns across cases. In addition, it gives the author a rich familiarity with each case, in turn, accelerates cross-case comparison. Within-case analysis typically creates detailed case study write-ups for each site. These write-ups are presented in Chapter 6 section 6.6.

➤ **Cross-case Analysis: connecting categories and analytical generalization**

Coupled with within-case analysis is cross-case search for patterns through connecting categories and analytical generalization. Overall, the idea behind cross-case analysis is to, as Eisenhardt and Bourgeois (1988) suggest, force the researcher to go beyond initial impressions derived from each individual case, especially through the use of theoretical frameworks and analytical templates with which to compare the empirical data of case study. Theoretical frameworks and analytical templates applied have been presented in chapter 4 from which the author created a 'start list' of top-level codes. Upon these explanatory statements of characteristic, pattern codes have been further developed to identify emergent theme and pattern. Such coding enables data from different case companies to be readily compared and emergent themes identified. Any linkages between and within the process,

content and context of strategy can be analysed. This enables the key features of manufacturing strategy paradigm to be identified and described.

Two major cross-case coding tactics have been applied by author. One is to structure data into three dimensions of strategy development - 'context', 'content' and 'process', and then look for within-group similarities in terms of common management paradigm therein coupled with intergroup interactions. Another is to divide the data by data source. This tactic was used in the separation of the analyses of qualitative and quantitative data. When an emerging pattern from qualitative data source is corroborated by the evidence from quantitative data source, the finding is stronger and better grounded.

5. 5. Validity and Reliability of Research Design and Methodology

As stated at the outset of this chapter, research design and methodology is the logical sequence that connects the empirical data to a study's initial research questions and ultimately, to its conclusions (Yin, 1994, p19). Therefore, one could judge the quality of any given research design according to certain logical tests. Four tests, however, have been commonly used to establish the quality of empirical social research (see Kirk and Miller, 1986, p.26-29).

- *Construct validity*: establishing correct operational measures for the constructs being studied
- Internal validity (for explanatory or causal studies *only*, and not for descriptive or exploratory studies): establishing a causal relationship, whereby certain conditions are shown to lead to other conditions
- *External validity*: establishing the domain to which a study's finding can be generalized
- *Reliability*: demonstrating that the operations of a study - such as the data collection procedures can be repeated, with the same results

This list is much more complete than the standard "validity" and "reliability" notions to which most case studies in the manufacturing strategy literature have been exposed. Given the 'exploratory nature' of this study, three tests have been applied to measure the strength and limitations of the research design.

(i) Construct Validity

This first test is, in general, especially problematic in case study research. People who have been critical of case studies often point to the fact that a case study investigator fails to develop a sufficiently operational set of measures for constructs and that "subjective" judgements are used to collect the data.

However, in this study all *context*, *content*, and *process* constructs have been defined in 'operational/measurable' terms in the light of the literature during the construction of framework of analysis for the research (see Chapter 4). Also, two tactics have been applied in the research to increase construct validity. The first is the use of three types of

'triangulations' presented in the previous section in a manner to encourage convergent line of inquiry during data collection and analysis process. Multiple sources of evidence, multiple investigators, and multidimensional theoretical perspective, provide multiple measures of the phenomenon under investigation. A second tactic is to have the draft of case study report reviewed by key informants at Yanshan during the composition of the thesis.

(ii) External Validity

This second test deals with the problem of knowing whether a study's findings are generalizable beyond the immediate case study. The external validity problem has been a major barrier in doing case studies. Critics typically state that single case offers a poor basis for generalizing. However, Herriott and Firestone (1983) and Harris and Sutton (1986) suggest that multiple cases offer the researcher a deeper understanding of the processes and outcomes of cases, better chance to explore, delineate, explain locally grounded configurations. And the evidence from multiple cases is often being considered more compelling, and the overall study is therefore regarded as being more robust. Therefore, this study has applied multiple-case design following replication logic to address this concern.

Also the tactic of 'overlapping data collection and analysis' has been applied to address the concern for increasing the validity of empirical generalization. The central idea of overlapping data collection and data analysis, as Sutton and Callahan (1987) suggest, is that the theory-building process could be intimately tied with evidence - iterating toward a theory which closely fits the data, which make the research takes advantage of new insights possible from the data and yields an empirically valid generalization.

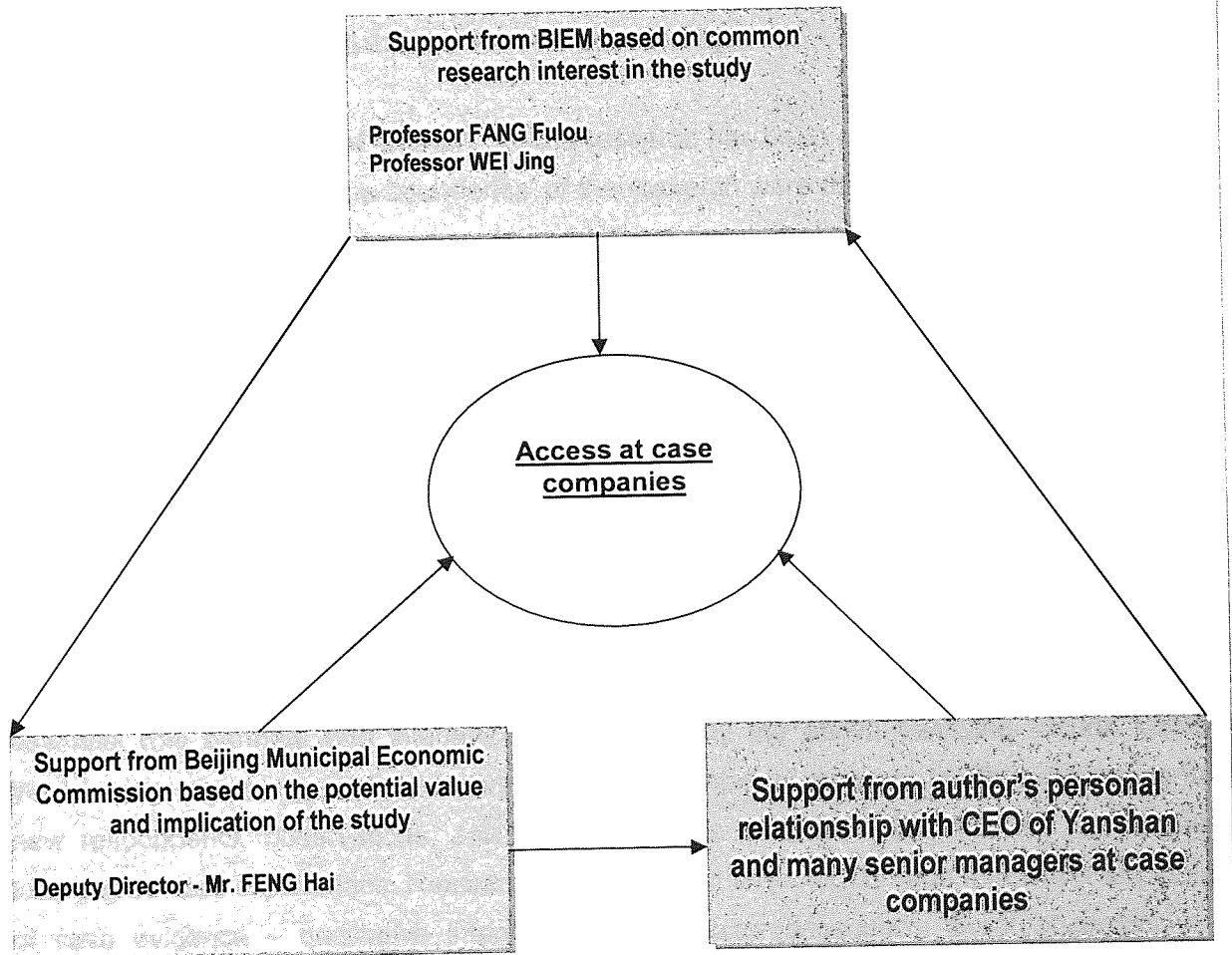
(iii) Reliability

This test is to be sure that, if a later investigator followed exactly the same procedures as described by an earlier investigator and conducted the same study all over again, the later investigator should arrive at the same findings and conclusions. The goal of reliability is to minimize the errors and biases in a study. The way of approaching the reliability problem during this study is the application of case study protocol, which has been presented in detail in previous sections. However, the general idea is to make as many steps as operational as possible to conduct the case study.

5. 6. Access at Case Companies

Access at case companies has been arranged via the triangulation of three approaches (see Figure 5.7).

Figure 5.7 Triangulation of approaches for gaining access at case companies



Granted access at the case companies has been well demonstrated by the 'letter of support' issued by the CEO of Yanshan for the research project (see attached document in appendix).

5. 7. Conclusion

In the foregoing six sections this chapter has presented and explained in details the research design and methodology adopted for empirical investigations. To recap, this study adopts a qualitative exploratory case study approach with semi-structured front-end research design. Following this overall research design, in conducting empirical investigations this study has applied a multiple-case design to address the concern for a deeper understanding of the cases, better chance to explore, delineate, explain locally embedded configurations, and better precision, validity, reliability of the research findings.

In summary, first the 'unit of analysis' for the research has been defined as the SBU level of the firm. Then, specific 'time boundaries' of the research were defined with beginning of the case as GCS/MES reform experiments in 1997 and the end of the case in late year 2000. This followed by statement of reasons for choosing large-scale SOEs in China's petrochemical industry as the 'population' of the research. Through applying the logic of theoretical sampling for cases, this project has chosen Yanshan as the 'sample' from the research population. Given the unit of analysis defined earlier, five SBU divisions in the core petrochemical business of Yanshan were chosen as 'case companies' in this study in which the development of manufacturing strategy is the independent event occurred in each of them. Within-case sampling has been carried out in the light of Fine and Hax's (1985) model of integrating manufacturing decision-making into strategic context of business operations. In this project, within-case sampling has also been investigative. The author started with essential role partners and interactions addressed by the above sampling model. While interviewing, observing, and picking up documents, empirical evidence leads investigation to new respondents, observations, and new documents needed to be included for deeper locally grounded explorations. Research data has been collected through four major sources of case evidence – qualitative interviews (semi-structured/focused), direct observations, documentations, and archival records. Two principles applied to the data collection process are 'triangulation' and 'overlapping data collection and data analysis'. Of special note to the convergence of multiple sources of case evidence is the combining of 'qualitative' with 'quantitative' evidence. In this study, the fieldwork has involved steady, integrated collection of both quantitative and qualitative data. Only when all of the evidence has produced a consistent picture was the author satisfied that the particular strategy development practice studied has actually occurred in a certain manner discovered.

6. Case Studies into the Practice & Perception of Strategic Manufacturing Management

6. 1. Introduction

This chapter presents the 'within-case' preliminary data analysis on case evidence collected in the field. However, in order to present a holistic account of the strategic manufacturing management practices performed at case companies, this chapter is structured with multiple levels of analysis.

First, an overview is provided at the macro level of China's petrochemical industry. Corporatization of large-scale SOEs through GCS/MES reform programmes has been singled out as the analytical focus here. This has been further reflected and discussed at the group level of case companies - Yanshan.

Second, at the corporate level of the case companies - Yanhua, data analysis comes into details on key aspects of business operations which including: organization structure, major products and production processes, supply of production inputs, product pricing, sales and marketing, product delivery, performance of business operations, business competition and competitive performance, and corporate strategy.

As stated in previous chapter, the development of manufacturing strategy primarily occurred at SBU level. Here preliminary data analysis is presented in the form of case study report at five business divisions of Yanhua including: company profile and business performance, contact summary form of filed investigations, environmental and organizational context of business operations, competitive strategy, business and manufacturing strategy process, and manufacturing strategy content.

The presentation of case study report uses a combined format of descriptive presentation of operations and production data (figures, charts, diagrams) and analytical paraphrase of managerial perceptions surfaced.

6. 2. Industry Overview

China's petrochemical industry constitutes a basic industrial sector, which has been a strategic focus of development by the Chinese government. In 2000, the aggregate GDP of China's petrochemical industry (including petroleum processing and production of organic chemicals, resins and plastics, synthetic rubber, synthetic fibres and chemical fertilisers) accounted for approximately 15.3 per cent of China's aggregate industrial GDP (The PRC Chemical Industry Yearbook 2001).

China's petrochemical industry produces more than 1,500 kinds of petrochemical products, which are widely used in other industries, including textiles, agriculture, construction, shoes, housewares, packaging, electronic appliances and automobiles industries. There have been many different ways to segment the industry applied by previous commercial market research such as according to distribution channels, ultimate users. However, from a manufacturing point of view the most relevant way to segment the industry is according to product types. Yanshan and most of other large-scale SOEs in the industry manufacture products, as referred by interviewees, principally belong to three such segments: (i) basic organic chemicals (ii) resins and plastics (iii) synthetic rubber.

➤ Resins and Plastics

Resins and plastics have board applications. The level of demand in China for resins and plastics is heavily tied to the development of agricultural, industrial and construction-related and automobile industries and the consumption of customer products such as housewares, household electric appliances, toys and packaging materials. Each of these industries utilises specific types of resins and plastics based on the particular requirements of its products and depending on the hardness, plasticity, heat resistance, abrasion performance, elongation, and other characteristics of each type of resin and plastic. Due to the rapid development of China's economy, domestic consumption of resins and plastics has grown at a compound annual rate of 12.3 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 for resins and plastics in China significantly exceeded domestic production, with imports accounting for approximately 60.6 per cent of domestic consumption despite governmental restrictions on imports and protective tariffs at rate of 15 per cent (Import-export Information of Products of the Chemical Industry 2001).

➤ Basic Organic Chemicals

Due to the rapid development of China's economy, production of basic organic chemical products in China has not been sufficient to meet domestic demand, despite substantial development of the petrochemical industry in China. China's domestic consumption of basic organic chemical products has grown at a compound annual rate of approximately 13.7 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 for organic chemical products in China exceeded domestic production, with imports accounting for approximately 40.8 per cent of domestic consumption (Import-export Information of Products of the Chemical Industry 2001).

Ethylene is one of the most important petrochemical raw materials used in the production of downstream petrochemical products. The production of ethylene is a significant indicator of the development level of a country's petrochemical industry. China largely supplies its own ethylene needs with imports accounting for less than 0.1% (Import-export Information of Products of the Chemical Industry 2001). In 1996, China domestic ethylene production was approximately 3.0 million tonnes. The PRC government's ninth five-year plan for 1996-2000 identified ethylene as a priority product for further development and targeted annual domestic production capacity of ethylene to increase to approximately 4.2 million tonnes by 2000.

➤ Synthetic Rubber

The level of demand in China for synthetic rubber is heavily tied to the tyre industry, as well as certain other industries such as housewares, shoes, toys and mining. Each of these industries utilises specific types of synthetic rubber based on the particular requirements of its products and depending on the hardness, heat resistance, abrasion performance, elongation, and other characteristics of each type of synthetic rubber. Due to the rapid development of China's economy, its domestic consumption of synthetic rubber has grown at a compound annual rate of 15.5 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 for synthetic rubber in China exceeded domestic production, with imports accounting for approximately 40.6 per cent of domestic consumption (Import-export Information of Products of the Chemical Industry 2001).

In early 1970s, the PRC government established a number of petroleum refining and petrochemical production and processing facilities in large complexes to permit the integration of the production of petroleum products, basic organic chemical products, resins and plastics, synthetic fibres and synthetic rubber. During this period, as part of the PRC government's policy to develop the raw material base for the petrochemical industry, the PRC government purchased from overseas the first 300,000 MTA rated capacity ethylene facility in China, which was installed in Yanshan in 1973 and begun operating 1976.

Since the late 1980s, the PRC government has implemented various economic reform programmes, which have materially affected China's petrochemical industry in areas such as cost and allocation of raw materials, product pricing, marketing and distribution of products. The China National Petroleum Corp. (CNPC) and the China Petrochemical Corp. (SINOPEC) were established in 1983 and have been authorised by the PRC government to administrate and hold controlling interests in a majority of the large-scale petrochemical SOEs in PRC. Detailed discussion on reform programmes and corporatization of SOEs in China's petrochemical industry will be presented in later section. Within the above overall reform context, the reorganization of China's two giant controlling companies in petrochemical industry - CNPC and SINOPEC will be further discussed in detail.

6. 3. Corporatization of SOEs in China's Petrochemical Industry

In broad terms, China's ongoing programme of SOE reform has aimed at giving SOEs progressively greater autonomy from the state, while also forcing them to take more responsibility for their own profits and losses and to be more responsive to market signals in their business operations. In other words, from being "social and economic conglomerates" responsible for "social goods", such as cradle-to-grave welfare for employees and their dependents, as well as for production, and not subject to hard budget constraints, large SOEs are supposed to transform themselves into purely "economic entities", which can be expected to operate in a much more entrepreneurial way and to compete in the international as well as domestic markets. Particularly since the start of the Modern Enterprise System (MES)/ Group-Company System (GCS) reforms, this transition from near-total dependence on the state to a much more autonomous and market-oriented mode of business operation has been referred to as the "corporatization" of large industrial SOEs (Hassard, Sheehan, and Morris, 1999).

MES and GCS are models of enterprise reform currently being piloted in a limited number of SOEs in China. These two interlinked reform programs for large and medium-sized SOEs were launched in the late of 1990s, and are to run until 2010, although preliminary results has been assessed by National People's Congress (NPC) and State Economic and Trade Commission (SETC) at year 2000. The main focus of reform efforts is a group of 176 large state enterprises in China. Fifty-six of these enterprises were piloting the GCS (developing a parent holding company and a large group of subsidiary companies that will have a high degree of management autonomy from the parent), and 120 (increased from the original total of 100) were involved in the MES program. In fact, though, the 56 GCS pilots were also undertaking MES reforms internally. These corporations have been in the process of separating off all component parts involved in their core line of production from others that may be engaged in completely unrelated lines of business. What resulted were a parent holding company and a range of subsidiary companies. All sub-companies will eventually be formed into shareholding or limited liability companies that will be responsible for their own profits and losses, and that will be able to attract outside investment, borrow from banks, and enter into joint ventures with foreign companies in their own right. In other words, they will have "legal-person" status in their own right to a much greater extent than previously.

The formation of sub-companies serves a number of related purposes. The sub-companies are intended to spread responsibility for results throughout the group, to provide more

opportunities for gaining access to capital, especially overseas, and to absorb surplus labour from the core businesses operations. Dividend income from sub-companies (or profit quotas) can be used by the parent company to help cover social welfare costs where these have not yet been transferred to local government. In addition, since the relationships within the group are now to be governed by market principles, sub-companies are expected to pay for the provision of social services by the parent company.

In general, the GCS is intended to create large companies that can be internationally competitive in world markets, reorganizing their resources, assets, and structure. The working definition of the MES reform programme in China is *gaige, gaizao, gaizu* (reform, reconstruction, restructuring). Its main elements are: clarification of property rights, clear definition of rights and responsibilities, distinguishing between government and management functions, and scientific enterprise management. The MES, in general, is intended to bring in to Chinese SOEs modern management mechanisms and what are seen in China as important elements of the "Western," or capitalist, company structure, such as overall company direction by a board of directors that answers to shareholders, features that are believed to have enabled Western companies to fend off government interference more successfully than their Chinese counterparts. Reducing government/political interference in enterprise management is a primary aim of the MES. As part of the MES/GCS reform program, the Chinese government abolished all industrial ministries and set up corporations. It also designated the State Economic and Trade Commission (SETC) under the State Council as industrial policymaker and regulator. Sheng huaren, the former president of SINOPEC, became SETC chairman at this time.

In China's petrochemical industries, at the beginning of 1997 several SINOPEC wholly owned subsidiaries including **Yanshan Petrochemical Corp.**, Shanghai Petrochemical Corp., and Zhenghai Petrochemical Corp., were chosen as GCS reform pilots and undertaking internal MES reform experiments. The successful reform experiments in these pilot companies and their successful offering of stocks in both the domestic and international markets initiated the major reorganization of China's two giant controlling companies in petrochemical industry - CNPC and SINOPEC into two independent, fully integrated group companies in 1998. Each undertakes both upstream-oil exploration and production and downstream-refining, petrochemical, and distribution activities. CNPC traditionally engaged essentially only in upstream work, while SINOPEC focused on downstream activities.

Wu Bangguo, vice premier in charge of China's economic reform, has indicated that the reorganization of CNPC and SINOPEC is the most thorough reform of the oil sector since

1983's Contract Responsibility System (CRS) reform, and that it is regarded as a pivotal part of China's overall economic reform.

The reorganization involved reassigning some of SINOPEC's downstream assets to CNPC and some of CNPC's upstream assets to SINOPEC (see Tables 6.1 and 6.2). CNPC ended up with most of the oil fields, refineries, and petrochemical plants in northern China, while SINOPEC obtained those in southern China. Hence CNPC and SINOPEC are often referred to colloquially as the "Northern" and "Southern" companies, respectively. Before the reorganization, the two corporations had only limited rights to conduct foreign trade, but now can trade freely and independently in both the domestic and international markets. With assets totaling \$57.2 and \$45.8 billion, respectively, CNPC and SINOPEC rank among the world's top 500 industrial enterprises.

CNPC retained nine oil fields and companies, which together produce roughly 67 percent of China's total petroleum and 66 percent of national natural gas output, and acquired 19 facilities from SINOPEC. The Jilin Chemical Group Corp. and the Jilin Petroleum Group Co., Ltd. (originally under the Jilin provincial government, respectively) and 13 other provincial, regional, and municipal petroleum marketing companies were also transferred to CNPC. CNPC now employs 130,000 people and owns and operates 7,000 km of pipeline, 14.8 million cubic meters of storage capacity, and 5,000 gas stations nationwide.

SINOPEC kept 26 refineries and petrochemical plants, but also gained 12 CNPC oil fields and organizations. These fields produce roughly 22.5 percent and 10.7 percent of China's petroleum liquids and natural gas, respectively. The restructuring also transferred 22 provincial, regional, and municipal petroleum marketing companies to SINOPEC, creating a nationwide sales network. SINOPEC's employees total 1.19 million.

The organizational structures of CNPC and SINOPEC oil fields, refineries, petrochemical plants, and other regional offices remained as they were. Regional service organizations such as research institutes, design institutes, and computer centres kept their affiliations with individual oil fields, refineries, or petrochemical plants, and together either remained intact or were transferred to SINOPEC or CNPC. At the central level, several prominent institutes formerly under the Ministry of Chemical Industry (MCI) were reassigned to other organizations. For example, the Beijing Chemical Research Institute recently joined SINOPEC, further enhancing SINOPEC's downstream research capabilities. Central-level service organizations were to remain with their original parents.

SINOPEC retains its edge in downstream research and design capabilities. World-class institutes such as the Beijing Research Institute for Petroleum Processing, the Beijing Design Institute, the Beijing Petrochemical Engineering Co., and the Petrochemical Planning and Engineering Institute remained with SINOPEC. These elite groups are responsible for the development of most domestic processing technology, the assimilation of most foreign processing technology, and the design and technical supervision for the construction of all of China's refineries and petrochemical plants. CNPC essentially has no downstream research and design institutes, and it will take years, if not decades, for CNPC to build up expertise to match that of SINOPEC. Even though SINOPEC's research and design organizations may be available to CNPC on a contract basis, such collaboration would be awkward. It would be similar to BP Amoco relying on Chevron Corp. to conduct its research and design work.

Conversely, CNPC retains its own advantages in upstream research and design expertise. For example, it kept its Research Institute for Petroleum Exploration and Production, the Seismic Data Interpretation Computer Facility, and various core- and well-testing laboratories. SINOPEC is unable to build up comparable expertise in these areas anytime soon.

Following the lead of several SINOPEC pilot subsidiaries mentioned earlier, in 1999 CNPC and SINOPEC decided to finance future modernization and expansion plans by partially privatizing and offering stocks in both the domestic and international markets. Listings require that these organizations undergo further reorganization, asset valuation (including in-ground oil and gas reserves), and debt reorganization. Stock companies—CNPC Group Ltd., and SINOPEC Group Ltd., have been established to serve as operating entities. Parent corporations CNPC, SINOPEC will become *holding companies* with no less than 51 percent of the shares of the operating subsidiaries. The remaining shares will be offered on the Shanghai, Shenzhen, Hong Kong, and New York stock exchanges. All of CNPC and SINOPEC social-service organizations will remain under the *holding companies* so as not to increase the financial burden of the operating subsidiaries.

CNPC has been raising foreign capital through "risk contracts" and commercial loans from foreign financial institutions to develop offshore and onshore joint-venture oil fields. And several SINOPEC refineries are in the process of establishing joint venture operations with various international oil companies. CNOOC and the Royal Dutch/Shell Group will partner in China's largest petroleum and petrochemical joint venture. The Nanhai Project in Huizhou of Guangdong Province scheduled to begin production in 2003, which will produce 800,000 million tons of ethylene per year. SINOPEC and BASF AG planed to set up their joint venture

in Nanjing by June 2001. When operation starts in 2004, the plant will produce 600,000 million tons of ethylene a year. SINOPEC also signed a letter of intent with BP Amoco to build an ethylene plant in Shanghai. And Eton Mobil Corp., Dow Chemical Co., and some Saudi interests may work with SINOPEC on a giant joint petrochemical project.

Table 6.1
The China National Petroleum Corp. (CNPC)

Management

President	Ma Fucai
Vice Presidents	Huang Yan, Wu Yaowen, Ren Chuanjun, Yan Shanzhong

Natural and refined oil fields and oil refineries

Bohai, Hebei Province
Dagang, Hebei
Daqing, Heilongjiang Province
Liaodong, Liaoning Province
Qaidam Basin, Qinghai Province
Renqiu, Hebei
Tarim and Junggar Basins, Xinjiang Uygur Autonomous Region
Yuemen, Gansu Province

Production

Petroleum	70.2% of national total
Natural gas	73.0% of national total

Output of products

Petroleum	107 million tons per year	67.0% of national total
Natural gas	14.8 billion m ³	66.3% of national total

Major petrochemical plants (jointly operated with foreign firms or SINOPEC)

Dalian Petrochemical Corp., Liaoning Province
Dalian West Pacific Petrochemical Co., Ltd., Liaoning
Daqing Petrochemical Works, Heilongjiang Province
Dusanzhi Refining and Petrochemical Plant, Xinjiang Uygur Autonomous Region
Fushun Petrochemical Corp., Liaoning

Table 6.1. SINOPEC Refineries and Petrochemical Works (continued)

- Harbin Refinery, Heilongjiang
- Jinzhou Petrochemical Corp., Liaoning
- Jinxi Refinery and Chemical Plant, Liaoning
- Lanzhou Chemical Industry Corp., Gansu Province
- Lanzhou Refinery and Petrochemical Works, Gansu
- Liaoyang Chemical Fiber Co. (includes Anshan Refinery), Liaoning
- Linyuan Refinery, Heilongjiang
- Ningxia Chemical Plant, Ningxia Hui Autonomous Region
- Qianguo Refinery, Jilin Province
- Urumqi Petrochemical Works, Xinjiang

- SINOPEC Marketing Co. at Baoji, Shaanxi Province
- SINOPEC Marketing Co. at Harbin, Heilongjiang
- SINOPEC Marketing Co. at Jilin, Jilin
- SINOPEC Marketing Co. at Shenyang, Liaoning
- SINOPEC Marketing Northwest Co., Shaanxi

Capacity	2005	2006
Total refinery throughput capacity	107.0	45.6
Total ethylene capacity	1.3	41.0
Total synthetic resin capacity	1.2	30.5
Total synthetic rubber capacity	0.2	39.2
Total capacity for synthetic fiber raw materials	0.3	11.3
Total synthetic fiber capacity	0.5	57.3
Total chemical fertilizer (urea) capacity	2.8	40.9

SOURCE: CNPC Annual Report

Table 6.2
China Petrochemical Corp. (SINOPEC)

Management

President Li Yizhong
Vice Presidents Chen Tonghai, Wang Jiming, Mou Shuling, Zhang Jiaren

Major subsidiaries and operations (in millions of tons)

- Anhui Petroleum Exploration and Development Co., Anhui Province
- East China Pipeline Management Bureau, Shanghai
- Henan Petroleum Exploration Bureau, Henan Province
- Jiangnan Petroleum Management Bureau, Hubei Province
- Jiangsu Petroleum Exploration Bureau, Jiangsu Province
- Shengli Oil Field and its operator, the Shengli Petroleum Bureau, Shandong Province
- Shengli Petroleum Transportation Co., Shandong
- Southwest Petroleum Exploration Bureau, oil and gas fields in Sichuan, Guizhou, and Yunnan provinces, and Guaxi Zhuang Autonomous Region
- Xiangfan Petroleum Transportation Co., Hubei
- Xingxiang Petroleum Transportation Co., Henan
- Zhongyuan Petrochemical Co., Ltd., Henan
- Zhongyuan Petroleum Exploration Bureau, Henan

Production statistics

		Percent of national total
Estimated total reserves of petroleum liquids	—	24.4
Total petroleum production	36.0 Millions of tons per year	22.5
Total natural gas production	2.4 billion m ³ per year	10.7

Major refineries and petrochemical plants

- Anqing Petrochemical Works, Anhui Province
- Baling Petrochemical Corp., Hubei Province
- Beijing Yanshan Petrochemical (Group) Co. Ltd., Beijing
- Cangzhou Refinery, Hebei Province
- Fujian Refining & Chemical Co., Ltd., Fujian Province
- Gaoqiao Petrochemical Corp., Shanghai
- Guangzhou Petrochemical Works, Guangdong Province
- Jinan Refinery, Shandong Province

Refined enterprises and petrochemical plants (continued)

Jinling Petrochemical Corp., Jiangsu Province
 Jingmen Petrochemical Works, Hubei
 Jiujiang Petrochemical Works, Jiangxi Province
 Luoyang Petrochemical Works, Henan Province
 Maoming Petrochemical Corp., Guangdong
 Nanjing Chemical Corp., Jiangsu
 Qilu Petrochemical Corp., Shandong
 Shanghai Petrochemical Co. Ltd., Shanghai
 Shijiazhuang Refinery, Hebei
 Tianjin Petrochemical Corp., Tianjin
 Wuhan Petrochemical Plant, Hubei
 Yangzi Petrochemical Corp., Jiangsu
 Zhenghai Refining & Chemical Co., Ltd., Zhejiang Province

Other

Chongqing Yiping High Grade Lube Oil Corp., Chongqing
 The Great Wall High Grade Lube Oil Corp., Beijing
 Hubei Chemical Fertilizer Plant, Hubei
 Sichuan Vinylon Plant, Sichuan Province
 Yizheng Synthetic Fiber Corp., Jiangsu

Capacity	Million of tons per year	Percent of national total
Total refinery throughput capacity	117.9	52.1
Total ethylene capacity	2.2	55.0
Total synthetic resin capacity	2.8	37.3
Total synthetic rubber capacity	0.4	—
Total capacity of raw materials for synthetic fibers	2.0	37.3
Total synthetic fiber capacity	0.2*	67.0
Total chemical fertilizer (urea) capacity	3.4	50.0

SOURCE: SINOPEC Annual Report

NOTES: — not available

* does not include capacity of Yizheng Synthetic Fiber Corp.

The consensus, from the view of preliminary results assessment by NPC and SETC at year 2000 and from the recently reported view of top management personnel of CNPC, SINOPEC, appears to be that the piloting GCS/MES in 1997 and the following overall reorganization initiated in 1998 has generally been successful. Financial performance has recovered from the disruption caused by the reorganization (see Table 3). For 1999, CNPC achieved a net profit of Y15 billion (\$1.8 billion) and SINOPEC achieved a net profit of Y7.3 billion (\$881.6 million).

However, the extent to which these two major SOE reform programmes (GCS/MES) have been able to achieve the goal of creating a more autonomous, entrepreneurial, and profitable type of enterprise which, while remaining in overall state ownership, will be examined in this study, more specifically their effects on the management of operations competence at the

firm level in general and their implications to manufacturing strategy development in particular. The MES and GCS reform experiments, as stated above, were designed as long-term programmes due to run until 2010, so they are still less than halfway through their planned duration. Nevertheless, a preliminary assessment, in fact, has and can still be made at this stage, with the understanding that these are ongoing reforms on which a *definitive* verdict cannot yet be delivered.

Table 6.3 Performance of CNPC and SINOPEC

Indicator	CNPC	SINOPEC
Operational		
Production (million tons)		
1998	109.3	35.3
1997	143.7	—
1996	141.4	—
Production (billion m³)		
1998	15.5	2.3
1997	0.2	—
1996	16.4	—
Production (million tons)		
1998	68.2	80.6
1997	22.2	124.9
1996	18.2	118.0
Production (million tons)		
1998	14.8	16.5
1997	5.8	25.2
1996	4.6	24.3
Production (million tons)		
1998	21.5	23.2
1997	6.8	37.8
1996	5.3	34.5
Production (million tons)		
1998	1.3	2.3
1997	0.3	2.8
1996	0.2	2.5
Production (million tons)		
1998	2.6	4.6

6. 4. Beijing Yanshan Petrochemical Group Co., Ltd - Group Level

It has been revealed from pre-research field investigation at BIEM that Yanshan is recognized by leading Chinese scholars not only as a typical case of large-scale SOEs but also a critical and successful case of large-scale SOEs in China's petrochemical industry for management studies.

Yanshan was established in 1967 by China's Ministry of Petroleum. The company is located in Fangshan District, 50 kilometres southwest of downtown Beijing. In 1969, Yanshan completed the construction of three principal refining facilities. Thereafter, between 1969 and 1973, Yanshan completed more than 25 petrochemical production facilities. In 1973, with technology from ABB Lummus Crest Inc. in the United States, the company began the construction of its ethylene facility, with an annual production capacity of 300,000 tonnes, as well as a number of other production facilities that would utilise productions from the ethylene facility as their raw materials. In 1976, the ethylene facility began operating, establishing itself as the first facility with annual ethylene production capacity of 300,000 tonnes in China. In 1994 this ethylene facility was modified successfully by Yanshan which resulted in an ethylene production capacity increased to 450,000 MTA and achieved success of short construction period, low investment, high quality, and high benefits. The company thus made the advanced model of technical modification in China. In year 2000, the company further modified the facility successfully with self-developed technology, which resulted in an ethylene production capacity increased to 660,000 MTA. The SETC appraised this project as a creative one of continuous improvement, development in constructive ideas, constructive patterns and constructive methods.

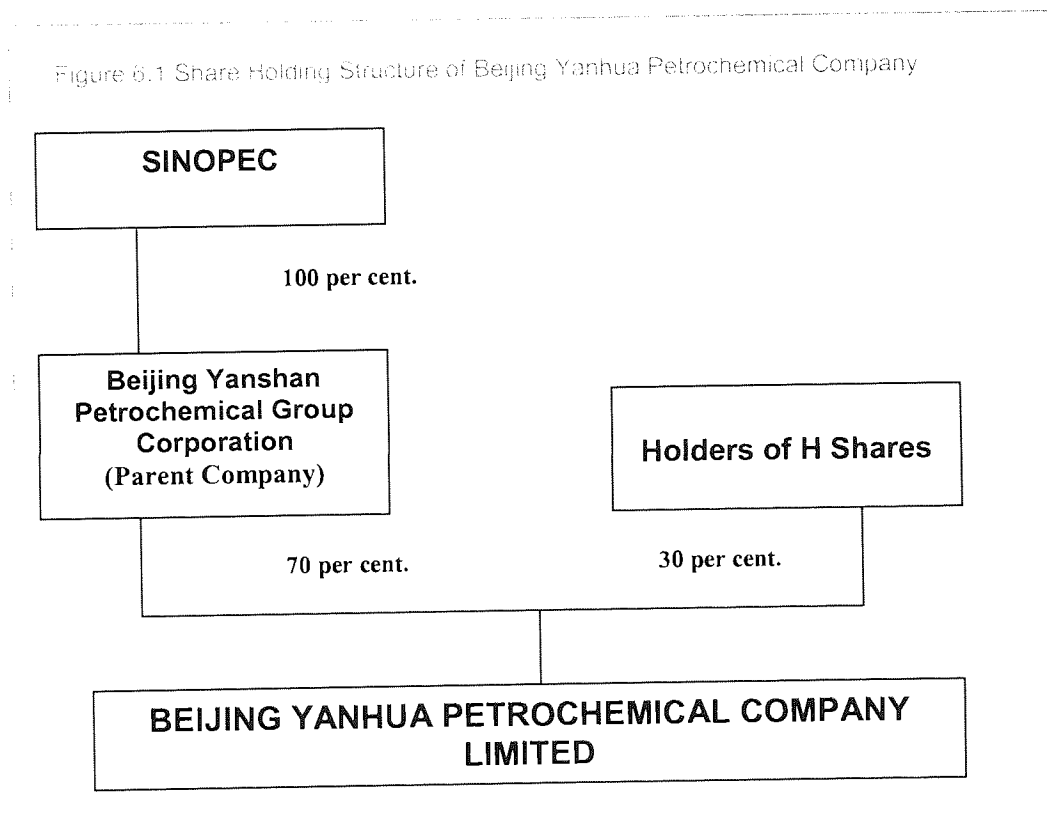
Since the first phase project put into operation in 1969, Yanshan has produced more than 160 million tonnes of petrochemical products providing the state with critical energy and raw materials for the modernizations of the industry, agriculture, and national defence. After putting into operation, the company has accumulated pre-tax profit of more than 35 billion RMB Yuan, which is equivalent to over 9 times of the total investment Yanshan obtained from the government. Yanshan is recognized by the Chinese government as one of the most critical petrochemical base in China with current 62 sets of production facilities producing 102 kinds with 227 grades of petrochemical products, processing 9.5 million MTA of crude oil and 660,000 MTA of ethylene. From 1988 to 2000, Yanshan has been consistently ranked the 10 largest SOEs in China based on sales revenue.

In respect of petrochemical production, Yanshan is the leader of China's petrochemical industry. In 2000, the company was the largest ethylene producers in China with annual rate capacity of 660,000 tonnes, accounting for approximately 16.6% of total ethylene production in the industry. Sales volume of the Yanshan's plastics & resins ranked the highest among all other Chinese enterprises in the industry in 2000. Yanshan also had the highest sales in China's domestic markets for cis-polybutadiene rubber, phenol and acetone. In respect of production efficiency, Yanshan is one of the highest among China's petrochemical producers in terms of raw material conversion, energy utilisation, and labour productivity. In respect of operations management, the company continued to keep on strengthening management quality and pushing the transformation of management system and economical growth pattern, do its endeavour to make Yanshan the most competitive manufacturer with first level technology, first level management quality and first level efficiency in the industry. The company was presented the highest prize "National Excellent Enterprises Award - Golden Horse Award" in 1996 by the China's National Enterprises Administration Association in recognition of its operational performance and management achievement.

Because Yanshan has consistently operated and performed well ever since it first established, many government officials both at Beijing Municipal level and Central Government level were previously managers of the company. Therefore, in recognition of leading Chinese scholars, Yanshan is a particularly noteworthy case for studying the reform and management of China's SOEs, and the research finding from such study could have significant implications in providing insights and guidelines for both the government and other cases in the population.

At the beginning of 1997 Yanshan as one of the SINOPEC wholly owned subsidiaries was chosen as GCS reform pilot and undertaking internal MES reform experiments. The restructuring was carried out to enable the company to separate off all component parts involved in its core line of petrochemical production from others that may be engaged in completely unrelated lines of business. The company's five core petrochemical business units - Ethylene Division, Polypropylene Division, Polyester Division, Basic Chemical Division, and Synthetic Rubber Division were restructured and further formed into a joint stock limited company "Beijing *Yanhua* Petrochemical Company Limited" under the Company Law of the People's Republic of China on 23rd April 1997. Yanshan retained the assets, liabilities and businesses not assumed by the Beijing *Yanhua* Petrochemical Company Limited, including a refinery unit, a chemical fibre carpet unit, a waste water treatment unit, a power plant, certain road and rail transport units, certain construction units and units providing certain social services such as health care, educational and public

security services and other ancillary services. All these retained units of Yanshan have also been further restructured and formed into joint shareholding companies that have "legal-person" status in their own right and are responsible for their own profits and losses. As a result of the restructuring, Yanshan became the parent holding group-company of a range of subsidiary companies. Beijing Yanhua Petrochemical Co., Ltd. has successfully listed on stock exchange in Hong Kong and New York in early 1998. The following Figure sets out the shareholding structure after the completion of the Combined Offering:



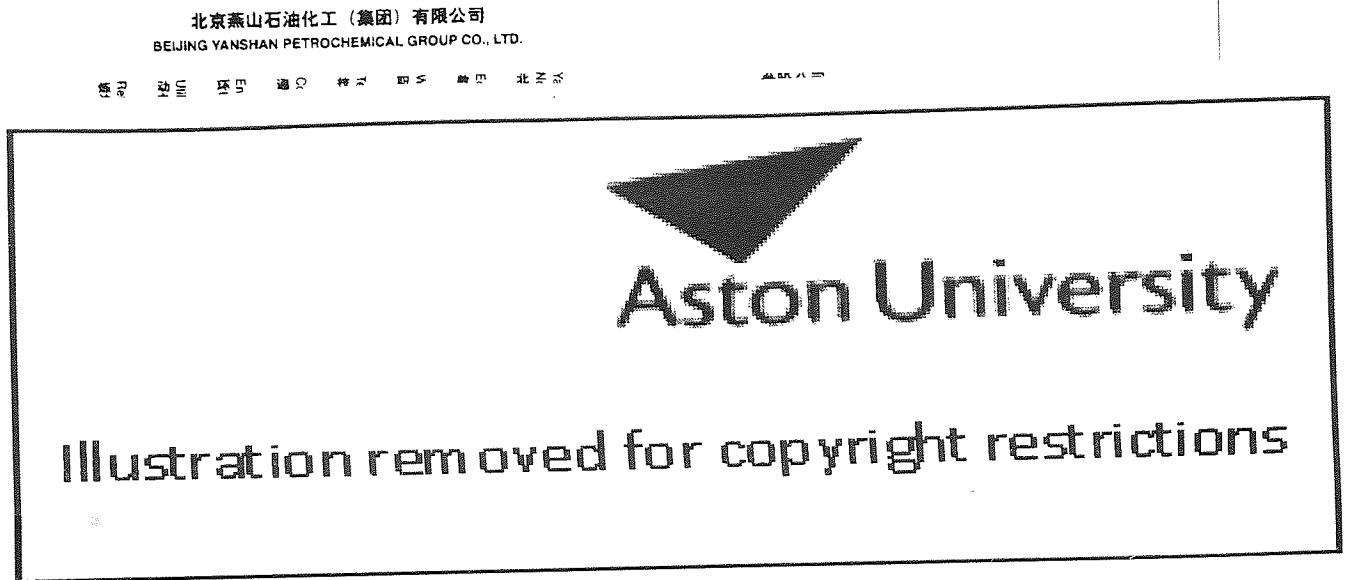
As illustrated by the Figure, immediately following the consummation of the Combine Offering, the Parent Company (Yanshan) owns 70 per cent of the issued share capital of Beijing Yanhua Petrochemical Co., Ltd, and therefore remains its controlling shareholder. Furthermore, the Parent Company is a wholly owned subsidiary of SINOPEC and has been authorised by SINOPEC to hold a controlling interest in Beijing Yanhua Petrochemical Co., Ltd (hereafter referred as Yanhua). As mention earlier SINOPEC has controlling interests in many other large-scale petrochemical enterprises that are major competitors of Yanhua in the domestic market. SINOPEC has confirmed in writing its equal treatment undertaking that within the scope of the administration and coordination of SINOPEC and in respect of all

transactions between the Parent Company (Yanshan) and Yanhua on the one hand and SINOPEC and its other subsidiaries on the other hand. The Parent Company (Yanshan) and Yanhua will be treated no less favourably than other enterprises directly or indirectly under SINOPEC's control.


As the businesses of Yanhua and the Parent Company (Yanshan) was all part of one entity prior to the restructuring, certain transactions between the Parent Company (Yanshan) and Yanhua continued after restructuring. These transactions will involve a cross-supply of materials and services between Yanhua and the Parent Company (and its other subsidiaries). For this purpose, Yanhua and the Parent company entered into a Supply of Materials and Services Contract. Pursuant to the contract, the Parent Company (Yanshan) continues to supply certain feedstock and utilities and to provide certain social services to Yanhua on a contractual basis. Yanhua provides certain raw materials and services to the Parent Company, also on a contractual basis. The Parent Company and Yanhua each pays reasonable fees for the provisions of relevant material and services.

Until the end of year 2000, 19 of Yanshan's business units have been restructured and formed into joint share holding company and another three of its subsidiaries have been listed on Shengzhen stock exchange in succession. The following Figure illustrates the current organization of Yanshan group:

Figure 6.2 Organization of Yanshan Group



Synthesis of RUBBER and PLASTIC



北京燕山石油化工(集团)有限公司
BEIJING YANSHAN PETROCHEMICAL GROUP CO., LTD.

四川燕兴石化实业有限公司
Sichuan Yanxing Petrochemical Industrial Co., Ltd.
上海中燕化工有限公司
Shanghai Zhongyan Chemical Co., Ltd.
西安石化有限公司
Xian Petrochemical Co., Ltd.
沈阳辽燕石化联盟公司
Shenyang Liaoyan Petrochemical Joint Venture Company

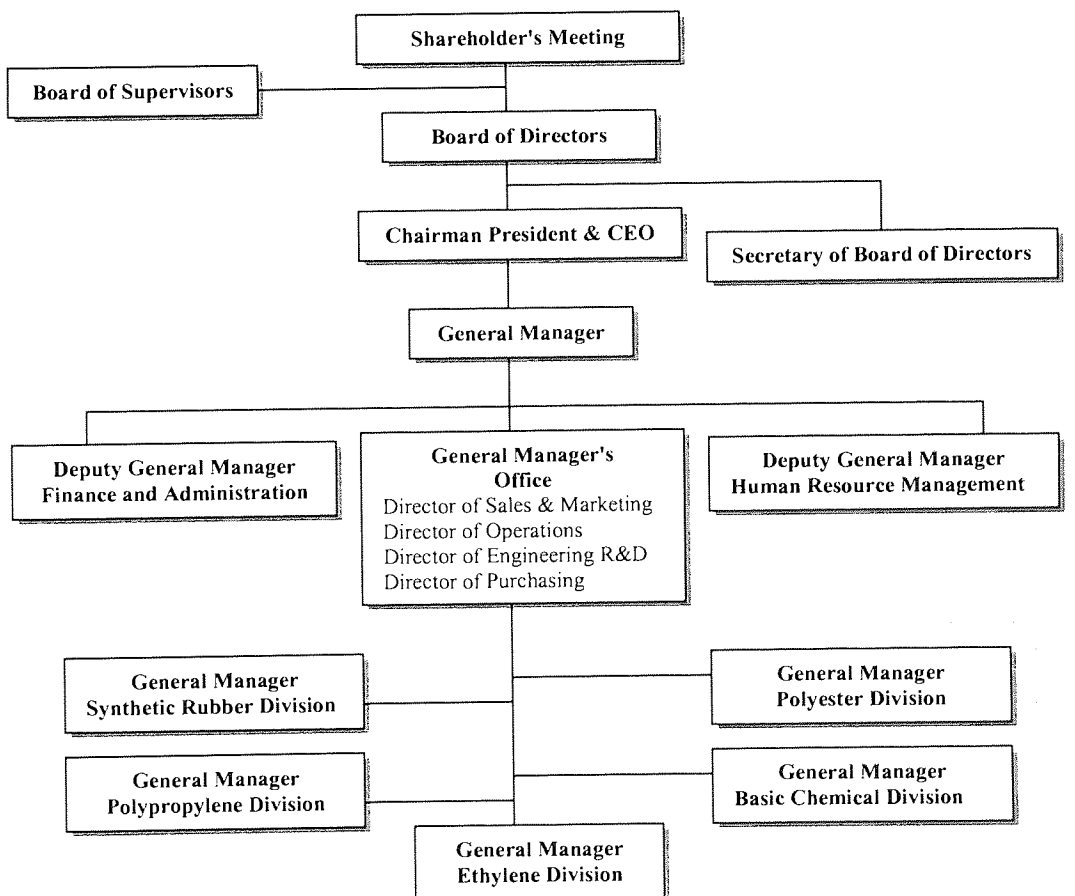
6. 5. Beijing Yanhua Petrochemical Co., Ltd - Corporate Level

6. 5. 1. Business Description

(i) Corporate Structure

The following chart sets out the organization structure of Beijing Yanhua Petrochemical Co., Ltd. As of 31st December, 2000, Yanhua had approximately 13,900 employees. Of these, approximately 1,330 were management and administrative personnel, approximately 2,300 were engineers and technicians, approximately 8,920 were factory personnel directly involved in production and approximately 1,360 were engaged in accounting, marketing and other production related functions. Approximately 20 per cent of Yanhua's workforce graduate from universities or technical colleges.

Figure 8.3 Corporate structure of Beijing Yanhua Petrochemical Co., Ltd



(ii) Principle Products and Production Process

The following tables set out Yanhua's principal products based on sales in each of 1999 and 2000 and the primary applications for each of the principal products.

Table 6.4 Principal Products and Sales of Yanhua 1999-2000

	2000		1999	
	Net Sales (RMB '000)	Percentage of net sales	Net Sales (RMB '000)	Percentage of net sales
<u>Resins and plastics</u>				
- LDPE	1,627,505.7	20.8%	1,297,391.2	20.1%
- Polypropylene	1,337,997.5	17.1%	1,181,206.9	18.3%
- HDPE	1,040,664.7	13.3%	819,744.7	12.7%
- Polyester Chips	610,314.7	7.8%	445,373.1	6.9%
- Polystyrene	344,280.0	4.4%	367,916.9	5.7%
Sub-total	4,960,762.7	63.4%	4,111,633.0	63.7%
<u>Synthetic rubber</u>				
- Cis-polybutadiene	907,647.5	11.6%	755,197.9	11.7%
- SBS	39,122.7	0.5%	51,637.4	0.8%
Sub-total	946,770.2	12.1%	806,835.4	12.5%
<u>Basic organic chemical products</u>				
- Ethylene	312,981.9	4.0%	284,006.1	4.4%
- Ethylene Glycol	273,859.1	3.5%	245,278.0	3.8%
- Phenol	500,771.0	6.4%	316,279.5	4.9%
- Acetone	242,560.9	3.1%	193,640.5	3.0%
Sub-total	1,330,172.9	17.0%	1,039,203.9	16.1%
Others*	586,841.0	7.5%	497,010.6	7.7%
Total	7,824,547	100%	6,454,683	100%
* No single chemical product in this category accounted for more than 0.1% of total sales in any of the respective year.				
Ethylene, Ethylene Glycol, LDPE, HDPE, and Polystyrene are <u>Ethylene Division's</u> principal products.				
Cis-polybutadiene and SBS are <u>Synthetic Rubber Division's</u> principal products.				
Polypropylene is <u>Polypropylene Division's</u> principal product.				
Phenol and Acetone are <u>Basic Chemical Division's</u> principal product				
Polyester Chips is <u>Polyester Division's</u> principal product.				

Table 6.5 Application of major products

Resins and plastics

- LDPE: thin films, boards, tubes, machinery parts, toys, housewares, electric wire and cable insulation
- Polypropylene: packaging materials, housewares, toys, household electric appliances, mechanical parts and synthetic fibres
- HDPE: thin films, industrial packaging materials, machinery parts, pipes, ropes, fish nets household containers and toys
- Polyester Chips: Polyester fibres, films, audio and video tapes and containers
- Polystyrene: lenses for automobile lights, optical devices, telecommunications devices, electronic appliances, housewares, water coolers, containers and packing materials

Synthetic rubber

- Cis-polybutadiene: Types, tubes, tapes and foot wears
- SBS: medical devices, adhesives and material to reform asphalt

Basic organic chemical products

- Ethylene: feedstock for many chemicals
- Phenol: dye intermediates, resins, solvents, plastics, synthetic fibres and chemical fertilisers
- Acetone: artificial oil, paint, explosives, organic glass intermediates, acetic anhydride, vitamin C and many organic chemicals.
- Ethylene Glycol: synthetic fibres, thin films, wet strength agents, antifreezing agents, softeners, heat transfer agents and electrolytic containers

Yanhua's production processes are highly integrated, and many of its products are consumed internally as feedstock for the production of other products. Yanhua's ethylene facility processes the cracking feedstock into various petrochemicals including ethylene, propylene, C4, various intermediate chemicals and certain by-products including cracking oil and various types of carbon-fraction. A majority of the ethylene is used to produce LDPE, HDPE, ethylene glycol and styrene. A portion of the styrene is further processed by the Yanhua's polystyrene, SBS and solution styrene butadiene rubber facilities, and the remainder of the styrene is sold to customers.

Yanhua uses the propylene as a principal feedstock for the polypropylene facility, the phenol-acetone facility and the meta-cresol facility to produce polypropylene, phenol, acetone, meta-cresol, para-cresol and BHT. A portion of the polypropylene is used by the parent company

(Yanshan)'s chemical fibre carpet sub-division as the principal feedstock to produce polypropylene fibre carpets.

Yanhua's DMF extraction facility and acetonitrile extraction facility use the C4 produced by the ethylene facility to produce butadiene, 1-butene and liquefied petroleum gas. The butadiene is used as a principal feedstock for cis-polybutadiene rubber facility and solution styrene butadiene rubber facility to produce cis-polybutadiene rubber and SBS. The 1-butene is used as feedstock by the MTBE facility to produce MTBE. The liquefied petroleum gas is sold to customers.

Yanhua's para-xylene facility uses mixed-xylene purchased from the parent company (Yanshan) to produce para-xylene, which is further processed by the company to produce terephthalic acid. The terephthalic acid and the ethylene glycol are the principal raw materials for the polyester facility to produce polyester chips, which are further processed to produce high viscosity polyester chips. The following chart sets out the principal productions processes of Yanhua.

Figure 6.4 Principal Production Process of Yanhua

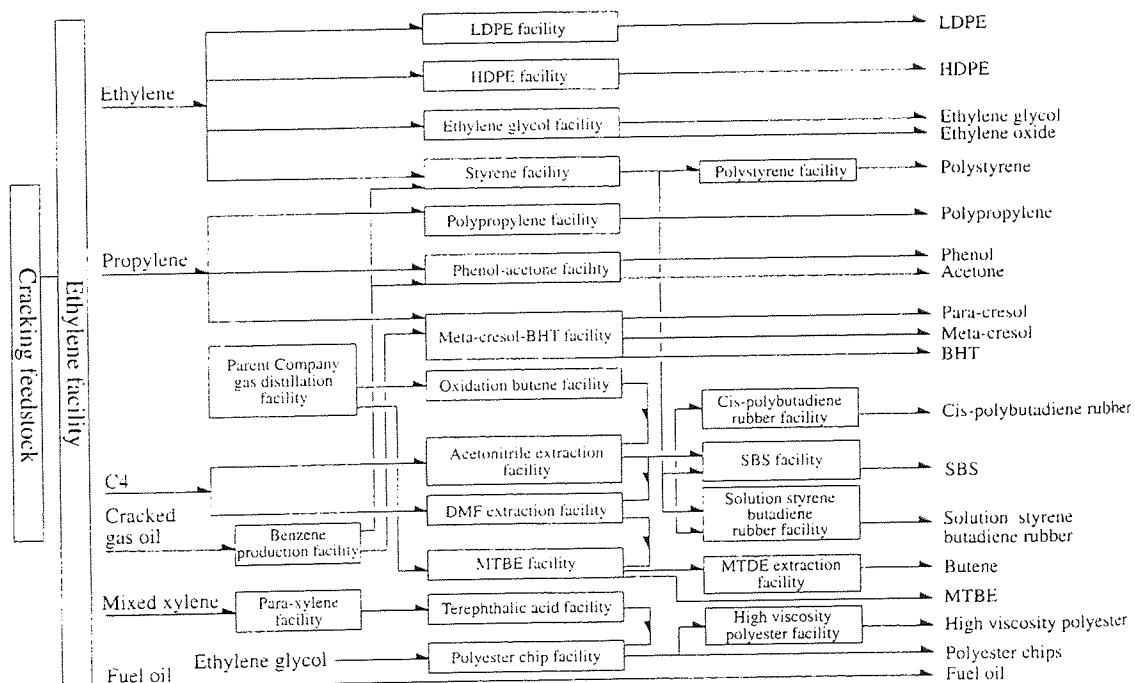


Table 6.6 Production Capacity of Yanhua's Major Facilities

<u>Facility</u>	<u>Rated Production Capacity</u>			<u>Percentage of SINOPEC</u>	<u>Percentage of Domestic Total</u>	<u>Source of Technology</u>
	<u>Yanhua</u>	<u>SINOPEC</u>	<u>Total Domestic</u>			
Ethylene	660	2470	4110	26.72%	16.06%	ABB Lummus Crest Inc. (USA)
Polypropylene	455	2050	2890	22.25%	15.74%	Mitsui Petrochemical Industries Ltd (Japan)
Polyester	40	1430	1840	2.8%	2.17%	Zimmer AG (Germany)
Cis-polybutadiene	120	530	810	22.64%	14.81%	PRC
Phenol-Acetone	100	201	251	49.75%	39.84%	Mitsui Petrochemical Industries Ltd (Japan)
LDPE	390	790	880	49.37%	44.32%	Sumitomo Chemical Co., Ltd (Japan)
HDPE	140	530	980	26.42%	14.29%	PRC
Ethylene Glycol	80	610	850	13.11%	9.41%	Scientific Design Co., Inc (USA)
SBS	50	107	107	46.7%	46.7%	PRC
Polystyrene	50	410	480	12.2%	10.42%	The Dow Chemical Company (USA)

(iii) Supply of Production Inputs

Cracking feedstock is the principal raw material for the Yanhua's production. In 2000, the cost of cracking feedstock purchased from the parent company (Yanshan) accounted for 84.4% and 45.4%, respectively, of the company's raw material costs and the company's production cost. In addition to cracking feedstock, the parent company also supplies the company with other raw materials, including benzene, mix-xylene, 1-butene and toluene. The following table shows the costs of raw materials, water and energy as percentages of total costs of production in 1999 and 2000.

Table 6.7 Cost of Production of Yanhua 1999-2000

	2000 (%)	1999 (%)
Production Cost	100.0	100.0
Cracking Feedstock from Parent company	45.4	46.2
Cracking Feedstock from Third party	0.4	0.6
Other Raw Materials from Parent company	8.0	2.5
Other Raw Materials from Third party	8.4	4.5
Water and Energy	10.2	10.8
Total Raw Materials, Water and Energy	72.4	64.6

Light industrial oil accounted for approximately 69.0% of the company's total cracking feedstock consumption in 2000 with the remainder being vacuum gas oil ("VGO"), cracking wax oil, hydrogenated raffinate oil, and naphtha. The company keeps in its storage facilities amounts of cracking feedstock sufficient to support 10 days of its production inputs.

Price for light industrial oil and naphtha are set by the State planning Commission and has remained at RMB 1,700 per tonne until 1997. Effective 25th December 1996, the State price for light industrial oil and naphtha was increased to RMB 1,850 per tonne. Since then the Yanhua has been using its self-developed cracking feedstock substitute, such as VGO, cracking wax oil and hydrogenated raffinate oil, which are less expensive and similar to light industrial oil, without compromising production efficiency and quality yield. In 1997, 1998 and 1999, the amount of less expensive substitute cracking feedstock used Yanhua accounted for 22%, 28% and 29%, respectively, of its total cracking feedstock. None of the alternative types of cracking feedstock is currently subject to State pricing control in the PRC. Yanhua purchased all of its VGO from the parent company (Yanshan) at RMB 1,300 per tonne. The parent company has also undertaken to provide cracking wax oil and hydrogenated raffinate oil to the company through 2001 at prices of approximately RMB 1,100 per tonne. These prices were determined with reference to market prices for similar products and costs of

production. The parent company has undertaken to give Yanhua the exclusive right of first refusal to purchase the cracking feedstock it produces.

The other principal raw materials, which Yanhua purchases from the parent company include benzene, mixed-xylene, 2-butene and 1-butene and toluene. Pursuant to the restructuring, the parent company has agreed to supply these raw materials to Yanhua at domestic market prices. This would provide "transport cost savings" for Yanhua given its proximity to the parent company. Yanhua has not experienced any difficulty in obtaining adequate supplies of these raw materials from the parent company. However, Yanhua also believes that there exist viable alternative sources which it could and would access in the future, should any such alternative sources present better prices or quality, or if the Yanhua's demand exceeds the supply available from the parent company.

Electricity is Yanhua's main source of energy. Yanhua purchases electricity through the parent company from the PRC's northern power grid. In general, the price of electricity in the PRC is set by the PRC government. Yanhua has not experienced any material disruption in electricity supply in recent years. Yanhua produces approximately 79.3% of its steam requirements internally and purchases the remaining steam requirements from the parent company. Currently, the company has seven boilers built within its five business divisions. In 2000, the company consumed 33.6 million cubic metres of water for its production processes as well as for producing steam.

(iv) Product Pricing

Prior to 1994, the prices of many of Yanhua's products were subject to government control. Since 1994, the PRC government has been gradually lifting price controls on many major petrochemical products and permitting an increasing number of these products to be priced according to market mechanisms. Commencing in May 1994, most of the company's principal products were permitted to be sold at prices set by the market. Currently, of the principal products produced by the company, only limited amounts of ethylene and LDPE are still subject to varying degrees of State pricing control. The State Prices for these products have been increasing and gradually brought into line with market levels in recent years.

In 2000, sales of products at State Prices accounted for approximately only 9.9 per cent of the Yanhua's total sales. Management of Yanhua believes that PRC government will continue relating State control over the pricing of petrochemical products.

With respect to the Yanhua's products which are not subject to pricing controls, pricing decisions are made by the company with reference to prices in the major chemical commodities markets in the PRC. Because imports constitute substantial portions of PRC domestic consumptions for many of the Yanhua's principal products, prices for these products in the PRC domestic markets fluctuate substantially in concert with international prices. Prices for many Yanhua's principal products have experienced substantial fluctuations over the last few years primarily due to fluctuations in international prices, especially Southeast Asian market prices, for these products. The respective domestic business environment for these products, therefore, is dynamic in nature. The company adjusts its product prices taking into consideration of international supply conditions, international pricing, tariffs for the relevant products, imports not subject to tariffs (such as imports into special economic zones for processing into products for export) and cost for transportation. Sales and marketing department of each business division has respective access to domestic and international market information through computerised data centre at parent company (Yanshan), which enabled the company to closely monitor pricing developments in major international commodities markets, particularly in Southeast Asia. The overall pricing strategy, as referred by Yanhua's top management, is to always keep an attractive low price position (average margin: 7 - 9%) compared to major foreign competitors. However, due to brand recognition and supply quality of conformance and reliability, Yanhua has been able to charge a small premium to market prices for many of its principal products compared to same product provided by other domestic producers.

(v) Sales and Marketing

Yanhua has three principal distribution channels: (i) direct sales to large and medium size manufacturing enterprises, (ii) sales to large trading companies for resales and (iii) distribution by the parent company (Yanshan)'s national sales network. In addition, among the company's principal products, limited amounts of ethylene and LDPE are subject to PRC government allocation controls. Yanhua also exports a small amount of its products. As of year 2000, the company had 490 employees whose primary responsibility is sales and marketing. The following table sets out the company's sales through each of the distribution channels in 1999 and 2000:

Table 6.8 Yanhua's Sales according to Distribution Channels 1999-2000

Distribution Channels	Percentage of Total Sales	
	1999	2000
Direct Sales	40.9%	41.8%
Trading Companies	36.4%	35.1%
Yanshan's National Sales Network	10.7%	12.8%
Sales Subject to State Location	11.4%	9.9%
Exports	0.6%	0.3%

Direct sales to downstream manufacturing enterprises accounted for approximately 41.8% of the Yanhua's total sales in 2000. The majority of these customers are enterprises engaged in manufacturing of a board range of finished chemicals, plastics, fibres and synthetic rubber products. In 2000, the company made direct sales to over 400 such manufacturing enterprises, of which the largest 10 customers accounted for 7.1% of total 2000 sales.

Sales to trading companies accounted for 35.1% of the company's Yanhua's sales. These customers are mainly large trading companies under provincial or municipal governments. Trading companies purchase the Yanhua's products for resale to medium and small size manufacturing companies throughout the PRC

Approximately 12.8% of Yanhua's 2000 sales were derived through the parent company (Yanshan)'s sales network. Such network consist of 17 entities, seven of which are wholly-owned by the parent company, seven of which are jointly owned by the parent company with other companies and the remaining three are companies with which the parent company has long-term cooperative relationships but no equity interests. These companies purchase the company's products for resale. This sales network covers 119 cities in 25 provinces. The company and the parent company plan to further expand this sales network so that it will cover most of the major cities throughout the PRC.

Sales products subject to State allocation accounted only for approximately 9.9% of company's total sales in 2000. The company is required to sell certain amounts of ethylene each year to Beijing Chemical Group Company, an unaffiliated company in Beijing, at prices set by the PRC government. In addition, the company is required to sell a limited amount of LDPE at below market prices to customers designated by the PRC government for production of agriculture-related products. Management of Yanhua believes that the PRC government will continue relaxing State control over the allocation of petrochemical products.

Although the company does not anticipate any significant change in the amount of its sales subject to State allocation in the near term, over time such sales are expected to decrease.

In 2000, export sales accounted for 0.3% of Yanhua's total sales. Export sales primarily consist of sales of cis-polybutadiene rubber to Hong Kong, Indonesia, Malaysia, Germany and Belgium. The company conducts its export sales through China Yanshan United Foreign Trade Co, Ltd. (an controlled subsidiary of Yanshan in which the parent company holds a 51% controlling equity interests). After the listing on the stock exchange in 1998, the company has applied for a licence to conduct import and export business on its own. As of 2000, the application was still in progress.

The sales & marketing department of each Yanhua's business division conducts routine customer visits and customer satisfaction surveys, information from which, together with macro market information, comprise the company's market data system. In addition, the company and all its business divisions have direct access to SINOPEC's data centre for domestic and international market information. Such information provides the basis for Yanhua's customer relationship maintenance and new customer development. As part of the company's efforts to become more market-oriented, all business divisions of the company also provide after-sale service including technical support and technology assistance to their customers. Management of Yanhua believes that it has established long-term relationships with most of its large and medium size downstream industrial customers, which relationships provide the company with a generally dependable and stable customer base.

Yanhua's has been constantly seeking new customers in the past five years since MES reform. Yanhua's sales & marketing director and managers from each business divisions attend annual chemical products trading conferences held by the SETC, the PRC internal Trade Bureau and SINOPE at which it takes orders from customers throughout the PRC. In addition, since 1996 Yanhua holds annual sales conferences to markets it products to its major industrial customers. Majority of the company's sales were arranged at such sales conferences pursuant to one-year sale-contract, which contracts generally specify quantities of products to be provided but allow prices of such products to be determined from time to time according to market conditions.

Domestic sales accounted from more than 99.2% of Yanhua's sales in 1996-2000. Sales of the company's products are concentrated in Beijing and Heibei, Shandong, Jiangsu, Zhejiang, Henan, Shanxi, Shaanxi, Gansu and Hubei Provinces. The following table sets out the company's sales by geographic regions:

Table 6.9 Yanhua's Sales according to Geographic Regions 1996-2000

	2000		1999	
	Sales (RMB Million)	Percentage of sales	Sales (RMB Million)	Percentage of sales
Northeastern China	219.1	2.8%	174.3	2.7%
Northern China	3,294.1	42.1%	3,104.7	48.1%
Eastern China	2,300.4	29.4%	1,762.1	27.3%
Central-southern China	1,025.0	13.1%	787.5	12.2%
Southern China	477.3	6.1%	322.7	5.0%
Northwestern China	86.1	1.1%	71.0	1.1%
Southwestern China	281.7	3.6%	174.3	2.7%
Total	7,824.5	100.0%	6,454.7	100.0%

(vi) Product Delivery

As indicated above, Yanhua's major customers are located throughout the PRC. The company principally use rail and road transport and pipelines for the transportation of its products. While the company's sales policy requires its customers to pay the transportation costs for the company's products. Timely and dependable delivery of products is, as referred by its top management, essential to the Yanhua's business success.

Products transported by road accounted for approximately 46.0% of the company's sales in 2000. The parent company (Yanshan)'s road transport sub-unit owns approximately 185 trucks. Such trucks are fully insured for any damages and third party liability. Approximately 39.0% of company's sales were delivered by railway in 2000. Pursuant to railway regulations, the company is required to submit its estimated monthly rail transportation needs to the Beijing Railway Bureau in order to reserve sufficient railway capacity to transport its products. The company's product transport is also subject to daily availability of adequate rail cases and rail capacity. Currently, the parent company (Yanshan)'s railway transport sub-unit has more than 720 rail cars, most of which are industrial chemical tank cars that can transport liquid products or raw materials, and 50.2 kilometres of railroad network connecting most of the production units of Yanhua and the parent company. Yanhua owns various storage areas and loading-unloading stations adjacent to its production units. Yanhua uses the parent company's road and rail transportation services pursuant to the service contact between the company and the parent company. To date, the company has not experienced any material difficulty in transporting its products.

6. 5. 2. Performance of Business Operations

Growth is one frequently used measure of business performance (Dess and Beard, 1984). In this study, growth was the favoured measure of business performance. However, instead of using growth in a single aspect of performance, growth in three major aspects of business performance were aggregated into a composite measure of growth: growth in sales, growth in operating profit, and growth in net profit.

The use of growth as the measure of business performance has a special appeal for this study. In the years preceding the fall 1999, when data were first collected for this study, China's petrochemical industry represented in this study was faced with severe challenge of the *substantial* increase in the weighted average price of crude oil. Many major PRC producers in the industry have been affected significantly for the business result of 1999 (second half) and 2000. As stated earlier in the section of 'production input supply', Yanhua's costs of raw material inputs for 2000 has gone up 7.8% compare with 1999 caused by this contextual challenge. Under these circumstances, growth provided a more rigorous test of business performance than perhaps any other measure of business performance that could have been devised.

Table 6.10 Yanhua's Performance of Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	7,824,547	6,454,683	5,384,467
Costs of Production	(6,664,093)	(5,270,592)	(4,683,780)
Gross profit	1,160,454	1,184,091	700,687
Selling, general and administrative expenses	(530,743)	(578,544)	(468,533)
Operating profit	629,711	605,547	232,154
Financial expenses, net	(97,893)	(98,417)	(61,322)
Other (expenses) income, net	(23,030)	9,916	2,002
Profit before taxation	508,788	517,046	172,834
Taxation	(161,029)	(170,625)	(57,035)
Net profit	347,759	346,421	115,799
The decline of Yanhua's business performance in 1998 has been essentially due to the disruption caused by the reorganization and restructuring of reform experiments.			

Due to the GCS reorganization and MES restructuring at Yanshan in 1997, the company's previous (including 1997) business and trading records need to be restated according to changes in the business assets configuration for comparison purpose. The author managed to sort out partly Yanhua's trading records for sales, operating profits, net profits restated according to the new business configuration of the company for years of 1996 and 1997. The decline of the company's business performance in 1998 has been essentially due to the disruption caused by the reorganization and restructuring of reform experiments. The following chart sets out the company's sales, operating profits, and net profits for the past five years from 1996-2000.

Figure 6.5 Sales Record of Yanhua 1996 - 2000

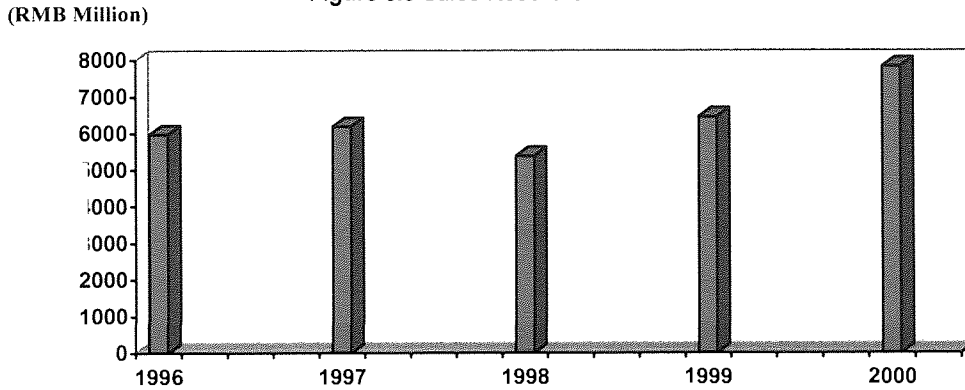
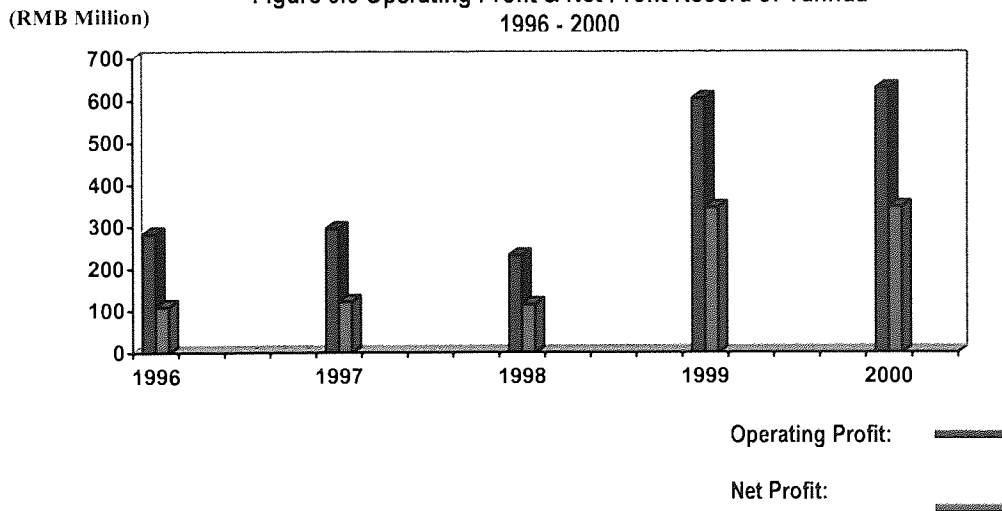


Figure 6.6 Operating Profit & Net Profit Record of Yanhua 1996 - 2000



6. 5. 3. Competition and Competitive Performance

Prior to 1993, because distribution and pricing of principal petrochemical products were determined in accordance with the State Plan. Yanhua and other SOEs in the industry was not operating in a competitive environment. With the liberalisation of control over pricing and product allocation by the PRC government, competition in the domestic market has increased significantly and is expected to intensify. In the recognition of the top management, across all three product categories the major competitors of Yanhua in domestic market are three other SINOPEC's wholly owned subsidiaries - Qilu Petrochemical Corp., Gaoqiao Petrochemical Corp., and Yangzi Petrochemical Corp. The management of Yanhua believes that its primary competitive advantages are high supply quality, cost competitiveness of production, and brand recognition.

In 2000, Yanhua ranked first in terms of aggregate sales volume of resins and plastics, first in LDPE and polypropylene. In aggregate, sales volume of the company's resins and plastics accounted for approximately 7.8% of the total PRC domestic consumption of these products in 2000 with imports accounting for approximately 60.6%. The company was the largest PRC producer of cis-polybutadiene rubber and the second largest SBS producer in 2000. In aggregate, sales volume of the company's synthetic rubber ranked first and accounted for approximately 9.9% of the total PRC domestic synthetic rubber consumption in 2000 with imports accounting for approximately 40.6%.

The company was the largest producer of basic organic chemical products in the PRC in 2000. In aggregate, sales volume of the company's basic organic chemical products ranked first and accounted for approximately 14.4% of the total PRC domestic consumption in 2000 with imports accounting for approximately 40.8%. The company is the largest producer of ethylene in the PRC and accounted for approximately 16.6% of China's ethylene production in 2000. Yanhua also ranked first in the PRC in terms of sales volume of phenol and acetone in 2000. The following table summarises the competitive position of Yanhua's principal products in the PRC domestic market in 2000:

Table 6.11 competitive position of Yanhua's principal products in the PRC domestic market in 2000

Principal Products	Yanhua's share of domestic consumption* (per cent)	Yanhua's PRC competitive ranking	Imports' share of domestic consumption* (per cent)
Resins and plastics	7.8%	1	60.6%
- LDPE	8.7%	1	79.2%
- Polypropylene	6.9%	1	47%
- HDPE	13.4%	2	39.3%
- Polyester Chips	6.9%	1	48%
- Polystyrene	3.7%	3	77.9%
Synthetic rubber	9.9%	1	40.6%
- Cis-polybutadiene	30.9%	1	5.9%
- SBS	13.2%	2	45.5%
Basic organic chemical products	14.4%	1	40.8%
- Ethylene	15.6%	1	**
- Ethylene Glycol	5.5%	2	31.8%
- Phenol	23.6%	1	48.7%
- Acetone	20.5%	1	72.1%

Sources: - Import-Export Information of Products of the Chemical Industry - The PRC Chemical Production Information - The PRC Petrochemical Industry Statistical Annual Report

* Domestic consumption is based on total production volume of the major PRC producers of the respective products plus imports and minus exports and inventory.

** Less than 0.1 per cent.

Prior to 1994, imports of many petrochemical products in PRC are subject to tariffs, import quotas and other restrictions. The PRC government also restricts the availability of foreign exchange with which the imports must be purchased. The combination of tariffs and quotas, as well as the restrictions on foreign exchange, has reduced, to some extent, the effect of foreign competition from imported products for the time being. Nevertheless, as the PRC domestic consumption of these petrochemical products substantially exceeds the domestic production capacity, imports account for significant proportions of many of the product markets in which Yanhua competes. Given the underlying growth in demand of these

products stated in earlier section, imports will continue to supply a substantial portion of the PRC demand for these petrochemical products for the foreseeable future.

In line with its general economic reform and in order to facilitate its entry to WTO, the PRC government has taken steps to reduce protection from import barriers. In particular, the PRC has begun, and is expected to continue, lowering import tariffs for these petrochemical products. Effective April 1996, the PRC government reduced the average level of tariffs from 36% to 23% for all imports. In accordance with these tariff reductions, tariffs on petrochemical products have been reduced to average level of 15%. Also as a result of reform of foreign exchange control laws, importing companies may purchase from PRC banks the required foreign exchange to pay for imported products by producing the relevant sales contracts and other evidence. China's entry into WTO will make domestic petrochemical producers even more susceptible to foreign competition. Average petrochemical and polymer tariffs, as a result of WTO requirements, will drop from current 15% to 10% in 2005.

The Yanhua's competitive performance will be discussed in depth at SBU level in the later section of case study reports using both substantive and perceptual measures in related to the bases for competition of the business operations.

6. 5. 4. Corporate Strategy of Yanhua

Building upon its position as one of the leading PRC petrochemical enterprises, Yanhua has a corporate strategy to develop its business competence to meet the rapid growth in domestic consumption of petrochemical products driven by the expansion of China's consumer and industrial sectors in order to achieve long-term competitiveness and earnings growth. This strategy consists of the following elements:

(i) Expand Production Capacity

The PRC's rapid growth in domestic consumption of petrochemical products presents a numbers of attractive market opportunities for Yanhua. The company intends to expand its production capacity of selected principal products in which the company believes (a) its existing market position for such products is strong and will be enhanced by such expansion, (b) PRC domestic consumption for these products is growing at a rapid rate and (c) PRC domestic consumption will continue to outstrip domestic production capacity for the foreseeable future. Principal products targeted for major capital investment include ethylene, LDPE, PET chips and polypropylene. The company's production expansion plans have been formulated in consistent with those of the parent company - Yanshan, which has completed an expansion of its crude oil refining capacity in the same period that substantially increased the ability to supply the Yanhua with cracking feedstock.

The PRC ninth five-year plan for 1996-2000 called for a substantial investment in construction or expansion of six ethylene facilities in the PRC. By the end of 2000, the total production capacity of ethylene in PRC reached 4.2 million MTA. The company's ethylene expansion project was one of the six projects contemplated by the ninth five-year plan. The LDPE expansion project was an integral part of the ethylene expansion project.

Yanhua has also commenced the expansion of polypropylene facility. The expanded polypropylene facility will enable the company to utilise the additional propylene to be produced following the anticipated expansion of its ethylene facility. Yanhua currently is the leading producer of polypropylene in the PRC in terms of aggregate sales and production volume in the PRC. Management of Yanhua believes that the polypropylene expansion will reinforce its long-term competitiveness in the domestic market. The following table sets out selected information on these major expansion projects of Yanhua:

Table 6.12 Major Modification Projects of Yanhua 1996-2000

PROJECTS	Rated Capacity (MTA)	Expanded Rated Capacity (MTA)	Increase in Rated Capacity (%)	Construction Period	Total Capital Expenditure RMB Million
Ethylene	450	660	46.7%	1998-2000	2,115
LDPE	180	390	117%	1998-2000	1,924
Polyester	300	400	33.3%	1998-2000	1,764
Polypropylene	155	455	194%	1998-2000	1,390

(ii) Enhance Operating Efficiency

Yanhua will focus on further enhancing its operating efficiency. Based on comparative production statistics on raw material conversion, energy utilisation, and labour productivity compiled by the SINOPEC, Yanhua is the most efficient domestic producer in PRC across all three categories. The company has managed to achieve increases in the cracking feedstock conversion rates of its ethylene facility in each of the past five years from 1996 to 2000. It continues to explore ways of improving its utilisation of feedstock and other raw materials. The company's ethylene division has developed the ability to use its self-developed cracking feedstock substitute, such as VGO, cracking wax oil and hydrogenated raffinate oil, which are less expensive and similar to light industrial oil, without compromising production efficiency and quality yield. In 1998, 1999 and 2000, the amount of less expensive cracking feedstock substitutes used by Yanhua accounted for approximately 28.0%, 29.0% and 30.0%, respectively, of the company's total cracking feedstock consumed. The company is also pursuing measures aimed at raising its energy efficiency and facility utilisation, such as importing certain production technologies to improve its existing production facilities. Yanhua has also achieved to extend the time between its scheduled plant shutdowns for maintenance from the current two years to three years through a combination of an improved maintenance programme and new production processes.

(iii) Improve Product Mix

Yanhua intends to shift gradually its product mix from general purpose petrochemicals toward more specialised types of its existing principal products. In order to realise this

objective, research and development department of each its business division has been working closely with customers in developing specialized modification of existing products with improved or customer-designed product performance index. Management of Yanhua believes that increasing emphasis on more specialised petrochemical products, which carry higher profit margins, will enhance the company's profitability and improve its long-term competitiveness.

(iv) Strengthen Sales and Marketing Activities

As the PRC is increasing transforming into a market-oriented economy, Yanhua's sales and marketing effort is focused on reinforcing its relationship with existing customers and gaining new customers. In order to achieve this, the company has expanded its direct sales force in all five of its business divisions to develop more directive sales to industrial customers. In addition, the company has also further expanded national sales network together with its parent company. Currently this sales network covers 119 cities in 25 provinces of the PRC and consists of 17 entities (see Figure 6.7). The company has also targeted to improve its service quality through improving the customer supporting activities that it has developed over the last several years. These activities include conducting surveys of customer demand and complain, expanding after-sale customer services to including technical support and technology assistance.

Figure 6 7 Yanhua's National Sales Network



Illustration removed for copyright restrictions

- (3) Sales Agents: Hebei sales agent (Shijiazhuang), Shanxi sales agent (Taiyuan), Chongqing sales agent
- (4) Trading Market: Yanshan Petrochemical Trading Center, Yantai Trading Market
- Sales Distribution of YSPCC's products

6. 6. Case Study Report of Five Business Divisions – SBU Level

6. 6. 1. Company Profile and Business Performance

This section provides a background introduction to Yanhua's five strategic business divisions. It includes company's history organized around the installation and development of its major production facilities, company's major products and their applications in the downstream manufacturing, industry competitions (domestic/foreign) in the company's segment and company's business performance since MES reform.

➤ Ethylene Division

Ethylene Division is one of the five strategic business divisions of Beijing Yanhua Petrochemical Co., Ltd (BYPC) and is a state-owned large-scale class I enterprise. The company is established in 1973. In 1976, its ethylene facility begun operating and became China's first set of ethylene facility with rated production capacity of 300,000 MTA. Ethylene facility processes the cracking feedstock into various petrochemical by-products including ethylene, propylene, C4, xylene, and various intermediate chemicals including cracking oil and various types of carbon-fraction. Ethylene is one of the most important petrochemical by-products and used as raw material in the production of many petrochemical products. The production of ethylene is a significant indicator of the capability of a petrochemical manufacturer in the industry. In 1994 the company's ethylene facility was modified successfully with imported technology from ABB Lummus Crest Inc (USA) which resulted in rated production capacity increased to 450,000 MTA. During 1998-2000, the company further modified the facility with self-developed technology and increased rated production capacity to 660,000 MTA. The company has other five sets of main production facilities including LDPE, HDPE, ethylene glycol, styrene, and polystyrene plant. The company also has five sets of auxiliary facilities such as waste water treatment plant, 85-ton boiler, 40,000 m³ air compression station, recycling water and treatment plant. The company has newly built a pilot plant with full-scale simulation facilities imported from America.

Ethylene Division's main products are ethylene, LDPE, HDPE, ethylene glycol, and polystyrene. The majority of ethylene produced is used by the company to produce LDPE, HDPE, ethylene glycol and styrene. A majority of the styrene is further processed to produce polystyrene, SBS and solution styrene butadiene rubber. LDPE can be used in many fields. It is the basic material in domestic chemistry and used to produce agricultural films, film for greenhouse, hollow products, coating material, cable insulating material and etc. HDPE is basic materials in plastic industry and used to produce various kinds of packing materials, large and small containers, and household sundries etc. Ethylene glycol is mainly used in producing polyester, and alkyl resin.

Polystyrene is mainly applied to processing instrument cover, optical instruments, automobile light cover, electric appliances component, low frothing, household appliances and etc.

There are three other major domestic producers of LDEP, HDPE, and polystyrene in the industry. They are Gaoqiao petrochemical Corp, in Shanghai, Qilu petrochemical Corp, in Shandong province, and Tianjing petrochemical Corp. The company has achieved and sustained its overall leadership among the domestic producers in terms of sale revenue, production efficiency, technological achievement, and quality standard. The major competition of the firm, as recognized by its top management, is from foreign participants in the industry (Interview 7 and 8, 1999). Performance outcomes of the company's business operations since the MES reform (1998-2000) are presented with Table 6.13, Figure 6.8 and 6.9, which are included in the Appendix F.

➤ Polyester Division

Polyester Division is one of the five business divisions of Beijing Yanhua Petrochemical Co., Ltd (BYPC) and is a state-owned large-scale class II enterprise. It's established in 1978. Now it has five main production plants such as xylene, oxidation, condensation polymerization, HIV PET and packaging plant, five sets of auxiliary facilities such as waste water treatment, 65-ton boiler, air compression station, recycling water treatment, and a pilot plant as training simulation centre.

Polyester production takes ethylene glycol produced by Yanhua's ethylene facility as major feedstock to produce polyester resin. Polyester Division's main products are three major categories of PET chips including bright polyester chip, semi-delustering polyester chip, PIA copolymerization polyester chip. Main application is as follow: to produce polyester fiber such as industrial or civil filament, to produce various film matrix including colour film, black and white film, x-ray film, printing film, record, video and movie film etc. Because the standard PET origin has reached its full maturity, given the life-cycle effects on product/process innovation, variation and development of the PET chips is essentially process-driven in the industry. That is the capabilities of production process in modifying standard PET origins according to the international product performance index of purity, dust content, metal content, thermal stability, and dyeing ability. The company so far has developed total 5 grades of customized modifications to the standard PET origins towards upper market of specialized usages. The majority of customers are downstream manufacturing enterprises engaged in producing of a board range of finished film matrix from household filming commodities to specialized industrial supply for medical and military usages.

There are four other major domestic PET chip producers in the industry. They are Dalian petrochemical Corp, in Liaoning province, Yangzi petrochemical Corp, in Jiangshu province, Xinjiang petrochemical Corp, in Xinjiang province, Liaohua petrochemical Corp in Liaoning province. The company has achieved and sustained its domestic leadership in the industry since

1989 for 11 consecutive years in terms of sale revenue, production efficiency, technological achievement, and quality standard. The major competition of the firm, as recognized by its top management, is from foreign participants in the industry (Interview 13 and 14, 1999). Performance outcomes of the company's business operations since the MES reform (1998-2000) are presented with Table 6.14, Figure 6.10 and 6.11, which are included in the Appendix F.

➤ Polypropylene Division

Polypropylene Division is one of the five strategic business divisions of Beijing Yanhua Petrochemical Co., Ltd (BYPC) and is a state-owned large-scale class II enterprise. The company is established in 1974. The first set of polypropylene facility was built and put into operations in 1976 using imported technology from Mitsui Petrochemical Inc. in Japan with a rate capacity of 80,000 MTA. The company's production takes propylene produced by Yanhua's ethylene facility as raw material through liquid initiation process to produce polypropylene resin then follows underwater pelletization and packaging for ex-works. After two technical modifications conducted in 1986 and 1987 using self developed technology the rate capacity of its polypropylene facility has been increased to 115,000 MTA and the facility has been capable to produce modified polypropylene resin for medical purpose downstream such as making hygiene bottles. In order to utilise the additional propylene to be produced following the expansion of Yanhua's ethylene facility, the company further modified its polypropylene facility in 1998 using imported technology from AMOCO Petrochemical Inc. in America. As the result, the rate capacity has been increased to 455,000 MTA and the facility has been capable to produce modified polypropylene resin first among domestic producers with high impact strength for automobile purpose. The company currently is not only the biggest polypropylene production base in China but also in the leading position of production technology and production efficiency among domestic producers. It now has three sets of polypropylene facilities, two sets of pelletizing facilities, one set of packaging facility, and four sets of auxiliary facilities including waste water treatment, boiler, air compression station, and a pilot plant for training simulation. Its fixed assets reach 4.6 billion RMB in year 2000.

The majority of polypropylene resin produced is sold to downstream manufacturing in domestic chemistry and plastic industries used as basic raw material. A small portion of the polypropylene is used by Yanshan's chemical fibre carpet plant as principal feedstock to produce polypropylene fibre carpets. The company's main products are standard polypropylene resin in three major categories of fibre, film, and copolymer. During the ninth five year plan from 1996-2000, the company has developed three grades of modification with high brightness for medical purpose (PP1728-PP1828-B250) and four grades of modification with high impact strength for automobile purpose (PP1540-PP1647-PP1740-PP1940).

There are two other major domestic producers in the industry. They are Jinling petrochemical Corp, in Jiangsu province and Shanghai petrochemical Corp, in Shanghai. The company has achieved and sustained its leadership in sale revenue among the domestic producers since 1994. In year 2000 it accounted for almost 25 per cent of total domestic sales and achieved sales income over 1.6 billion RMB. The major competition of the firm, as recognized by its top management, is from foreign participants in the industry (Interview 20 and 21, 1999). Performance outcomes of the company's business operations since the MES reform (1998-2000) are presented with Table 6.15, Figure 6.12 and 6.13, which are included in the Appendix F.

➤ Synthetic Rubber Division

Synthetic Rubber Division is one of the five strategic business divisions of Beijing Yanhua Petrochemical Co., Ltd (BYPC). The company is a state-owned large-scale class I enterprise. It's constructed in 1970 and put into operation in April 1971. The company's production uses the C4 produced by Yanhua's ethylene facility to produce butadiene, which is further processed as principal feedstock for cis-polybutadiene rubber facility and solution styrene butadiene rubber facility to produce cis-polybutadiene rubber and SBS. The company currently has total 11 sets of production facilities and 10 sets of auxiliary facilities. The company houses a 53,000 tons DMF extracted butadiene facility, a 16,000 tons butylenes oxidation/dehydrogenation facility, a 90,000 tons butadiene rubber polymerisation facility, the cis-polybutadiene rubber I and II facility, a 100 tons butylenes oxidation/dehydrogenation catalyst facility, a 150 tons tri-isobutyl aluminium catalyst facility, a 15,000 tons isobutene separation facility, a 2,000 tons polybutadiene facility, a 10,000 tons SBS facility and a 35,000 tons acetonitrile extracted butadiene facility. The auxiliary facilities include air distribution equipment, cooling equipment, water circulation equipment, and a simulation centre for staff training.

The firm's products are three major categories of synthetic rubber including cis-polybutadiene rubber, butyl rubber, and SBS (thermal plastic butadiene-styrene polymer). The total rated synthetic rubber production capacity is 210,000 MTA. The primary product of the firm is cis-polybutadiene rubber, which is currently accounting for more than 60 per cent of the firm's total annual synthetic rubber production. The cis-polybutadiene rubber plant has two production lines, which has a rated capacity of 25,000 MTA and 100,000 MTA respectively. The production capacity of cis-polybutadiene rubber is 125,000 tons per year, which is currently accounting for 23.58 per cent of the total annual domestic production. It has stepped into the line of the world 6 largest cis-polybutadiene rubber producers. Main application of cis-polybutadiene rubber is to produce various tyres, to produce various rubber tubes and cable wires, and to produce high impact polystyrene etc.

Cis-polybutadiene rubber is a matured, standard, and basic synthetic rubber product with only two general sets of grade variation for the product. The majority of the firm's customers for cis-

polybutadiene rubber are downstream tyre manufacturing enterprises and large trading companies. The industry segment of cis-polybutadiene rubber is highly concentrated with five major domestic producers currently occupied more than 94 per cent of the market share with imports from foreign producers accounting for less than 6 per cent of domestic consumption. The company's four major competitors for the domestic market are Dalian petrochemical Corp, Yangzi petrochemical Corp, Xinjiang petrochemical Corp, Liaohua petrochemical Corp. The firm has achieved and sustained its domestic leadership in the industry since 1994 for six consecutive years in terms of sales revenue, production efficiency, and technological achievement. Performance outcomes of the company's business operations since the MES reform (1998-2000) are presented with Table 6.16, Figure 6.14 and 6.15, which are included in the Appendix F.

➤ Basic Chemical Division

Basic Chemical Division is one of the five strategic business divisions of Beijing Yanhua Petrochemical Co., Ltd (BYPC) and is a state-owned large-scale class II enterprise. The company is established in 1978 with two major sets of production plants – phenol-acetone facility and meta-cresol facility and one set of packaging plant. The first set of phenol-acetone facility was built in 1979 and put into operations in 1981 using imported technology from Mitsui Petrochemical Inc. in Japan with a rate capacity of 68,000 MTA in processing cumene and 80,000 MTA in producing phenol-acetone. In 1998, following the modification of Yanhua's ethylene facility FX-01 molecular sieve catalyst process of cumene synthesis was adopted by the company to modify the phenol-acetone facility. After the modification, cumene capacity was expanded to 85,000 MTA and phenol-acetone capacity was expanded to 100,000 MTA. The company is currently the largest single line phenol-acetone facility in China. The meta-cresol facility was imported in 1978 from UOP and Hercules Inc. in America and put into operations in 1980 with a rated capacity of 120,000 MTA. Using the iso-propyl-toluene technology imported from Italy the company successfully modified meta-cresol facility in 1999. After the modification, meta-cresol capacity was expanded to 160,000 MTA and the facility can also produce phenol-acetone with a capacity of 45,000 MTA. The two sets of phenol-acetone capacity can reach 160,000 MTA which is currently among the 10 largest producers in world. The company also has five sets of auxiliary facilities such as waste water treatment plant, 60-ton boiler, 25,000 m³ air compression station, recycling water and treatment plant. The company has newly built a pilot plant with full-scale simulation facilities imported from Italy.

Basic Chemical Division's main products are phenol, acetone, para-cresol, meta-cresol and BHT. Phenol is used to produce phenolics, Bi-phenol A, caprolactam, aniline, alkyl-phenol, pharmaceuticals, pesticide and dyeing stuff intermediates. Acetone is a good solvent and important organic raw material, mainly used to produce Plexiglass, phenolics, acetic acid fiber, epoxy in chemical application field, and to produce antibiotic, hormone and vitamin etc. in pharmaceutical field. Meta-cresol and para-cresol are basic kind of chemical raw materials used to produce

synthetic resins and agricultural chemicals. BHT is the abbreviation for Butylated Hydroxy Toluene. It is mainly used as antioxidant for petroleum products, rubber, plastics, food products, food packaging and animal feeds.

There are two other major domestic producers of phenol-acetone in the industry. They are Qilu petrochemical Corp, in Shandong province, and Zhongyuan petrochemical Corp, in Henan province. The company has achieved and sustained its overall leadership among the domestic producers in terms of sale revenue, production efficiency, technological achievement, and quality standard. The major competition of the firm, as recognized by its top management, is from foreign participants in the industry (Interview 31 and 32, 1999). Performance outcomes of the company's business operations since the MES reform (1998-2000) are presented with Table 6.17, Figure 6.16 and 6.17, which are included in the Appendix F.

6. 6. 2. Contact Summary Forms

BYPC Ethylene Division

Beijing Yanhua Petrochemical Co., Ltd Ethylene Division
Gangnan Road No. 6, Fangshan District, Beijing
Postcode: 102508

Interview Contacts:

General Manager - Mr. ZHAO Shaohua
Interview 7 – 8:25-9:30 Mon, Nov 15, 1999
Follow up & Comments – 18:25-19:30 Tue, March 21, 2000

Secretary of General Manager's Office – Ms. LUO Wenmin
Short & Focused Interview – 10:00-10:30 Tue, 16 Nov 1999

Executive Manufacturing – Mr. WEI Zhansheng
Interview 9 – 14:00-15:35 Mon, Nov 15, 1999
Follow up & Comments – 20:10-21:35 Sun, March 27, 2000

Chief Engineer – Mr. BI Zhiqiang
Interview 11 – 10:00-11:30 Wed, Nov 17, 1999

Executive Personnel – Mr. YANG Qinghai
Interview 12 – 12:45-2:20 Wed, Nov 17, 1999

Deputy General Manager - Mr. HU Yun
Interview 8 – 9:45-11:20 Mon, Nov 15, 1999
Follow up & Comments – 18:25-19:30 Wed, March 27, 2000

Executive Marketing – Mr. ZHANG Shu
Interview 10 – 10:45-12:20 Tue, Nov 16, 1999

Executive Purchasing – Ms. WANG Yue
Short & Focused Interview – 16:35-17:25 Tue, Nov 16 1999

Executive Accounting –
Not Available

Party Branch Chair –
Not Available

Direct Observation:

Quarterly strategy reviewing (Winter/99-Spring/00) & Annual Summary meeting

Conference Room, General Managers Office, Tue, 14 December 1999
Contacts: Section 1 (9:00-12:00)
Lunch Break (12:00-15:00)
Section 2 (15:00-17:00)

On site Observation

Factory works – ethylene plant (partly), LDPE plant (partly), HDPE plant (partly), and styrene plant (partly) joint by Chief Engineer Mr. BI

Interviewees' Office – location, condition, work spaces, furnishings etc.,

Documentations & Archival records:

Mon 15 November – Wed 17 November 1999, Documentations & Archival records survey studies at Company's reference room.

BYPC Polyester Division

Beijing Yanhua Petrochemical Co., Ltd Polyester Division
Fenghuangting No. 1, Fangshan District, Beijing
Postcode: 102503

Interview Contacts:

General Manager - Mr. WANG Yongjian
Interview 13 – 8:50–9:40 Thu, Nov 18, 1999

Follow up & Comments – 12:25-13:30 Wed, March 22, 2000

Secretary of General Manager's Office – Ms. DONG Liying
Short & Focused Interview – 12:00-12:35 Tue, 21 December 1999

Executive Manufacturing – Mr. LI Jiyong
Interview 15 – 9:45-11:20 Friday, Nov 19, 1999
Follow up & Comments – 20:10-21:35 Sat, March 26, 2000

Chief Engineer – Mr. DONG Wenkai
Interview 17 – 15:00-16:40 Friday, Nov 19, 1999

Executive Personnel – Ms. WANG Lirong
Interview 18 – 8:15-9:45 Mon, Nov 22, 1999

Deputy General Manager - Mr. YANG Wancheng

Interview 14 – 10:30-11:30 Thu, Nov 18, 1999

Follow up & Comments – 17:25-18:40 Wed, March 22, 2000

Executive Marketing – Mr. LUO Yongjiang
Interview 16 – 12:30-14:35 Friday, Nov 19, 1999

Executive Purchasing – Mr. ZHAO Peng
Short & Focused Interview – 17:35-18:25 Tue, 21 December 1999

Executive Accounting – Mr. SHUN Jian
Short & Focused Interview – 08:25-9:00 Tue, 21 December 1999

Party Branch Chair –
Not Responded

Direct Observation:

Quarterly strategy reviewing (Winter/99-Spring/00) & Annual Summary meeting

Conference Room, General Managers Office, Tue, 21 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

On site Observation

Factory works – xylene plant (partly), oxidation plant (partly), condensation polymerisation plant (partly), and packaging plant joint by Chief Engineer Mr. DONG

Interviewees' Office – location, condition, work spaces, furnishings etc.,

Documentations & Archival records:

Thu 18 November – Friday 19 November 1999, Documentations & Archival records survey studies at Company's reference room.

BYPC Polypropylene Division

Beijing Yanhua Petrochemical Co., Ltd Polypropylene Division
Fenghuangting No. 3, Fangshan District, Beijing
Postcode: 102503

Interview Contacts:

General Manager - Mr. LIU Wanlu
Interview 19 – 11:20–12:40 Mon, Nov 22, 1999
Follow up & Comments – 10:45-12:15 Wed, March 21, 2000

Secretary of General Manager's Office – Mr. ZHOU Mingyi
Short & Focused Interview – 8:20-8:50 Wed, 22 December 1999

Executive Manufacturing – Mr. SHUN Lihong
Interview 21 – 9:45-11:20 Tue, Nov 23, 1999
Follow up & Comments – 14:10-14:35 Wed, March 22, 2000

Chief Engineer – Mr. WANG Fucheng
Interview 23 – 9:00-10:30 Wed, Nov 24, 1999

Executive Personnel – Ms. ZHOU Ping
Interview 24 – 11:15-12:45 Wed, Nov 24, 1999

Deputy General Manager - Mr. CUI Jinghao
Interview 20 – 13:25-15:30 Mon, Nov 22, 1999
Follow up & Comments – 14:45-15:20 Wed, March 22, 2000

Executive Marketing – Mr. WANG Hongwei
Interview 22 – 13:00-14:30 Tue, Nov 23, 1999

Executive Purchasing – Mr. SHI Jinsheng
Short & Focused Interview – 12:25-12:55 Wed, 22 December 1999

Executive Accounting – Mr. TIAN Yue
Short & Focused Interview – 17:15-17:40 Wed, 22 December 1999

Party Branch Chair –
Not Available

Direct Observation:

Quarterly strategy reviewing (Winter/99-Spring/00) & Annual Summary meeting

Conference Room, General Managers Office, Friday, 17 December 1999
Contacts: Section 1 (9:00-12:00)
Lunch Break (12:00-15:00)
Section 2 (15:00-17:00)

On site Observation

Factory works – polypropylene plant 1 (partly), polypropylene plant 2 (partly), polypropylene plant 3 (partly), pelletizing plant (partly), and packaging plant joint by Chief Engineer Mr. WANG

Interviewees' Office – location, condition, work spaces, furnishings etc.,

Documentations & Archival records:

Mon 22 November – Wed 24 November 1999, Documentations & Archival records survey studies at Company's reference room.

BYPC Synthetic Rubber Division

Beijing Yanhua Petrochemical Co., Ltd Synthetic Rubber Division
Gannan Road No. 4, Fangshan District, Beijing
Postcode: 102508

Interview Contacts:

General Manager - Mr. FU Wenliang
Interview 25 – 8:50–9:40 Mon, Nov 29, 1999
Follow up & Comments – 12:45-13:30 Tue, March 21, 2000

Secretary of General Manager's Office – Ms. CHE Fei
Short & Focused Interview – 12:10-12:45 Friday, 24
December 1999

Executive Manufacturing – Mr. ZHANG Zhiqian
Interview 27 – 13:45-14:40 Mon, Nov 29, 1999
Follow up & Comments – 15:10-15:45 Tue, March 21, 2000

Chief Engineer – Mr. ZHAO Zheng
Interview 29 – 9:00-10:30 Tue, Nov 30, 1999

Executive Personnel – Mr. MA Zhijie
Interview 30 – 11:15-12:45 Tue, Nov 30, 1999

Deputy General Manager - Mr. ZHAO Dali
Interview 26 – 10:25-11:50 Mon, Nov 29, 1999
Follow up & Comments – 14:25-14:50 Tue, March 21,
2000

Executive Marketing – Mr. LI Xianjin
Interview 28 – 17:00-18:15 Mon, Nov 29, 1999

Executive Purchasing – Mr. LIU Li
Short & Focused Interview – 8:10-8:55 Friday, 24
December 1999

Executive Accounting –
Not Available

Party Branch Chair –
Not Responded

Direct Observation:

Quarterly strategy reviewing (Winter/99-Spring/00) & Annual Summary meeting

Conference Room, General Managers Office, Friday, 24 December 1999
Contacts: Section 1 (9:00-12:00)
Lunch Break (12:00-15:00)
Section 2 (15:00-17:00)

On site Observation

Factory works – DMF plant (partly), butylenes oxidation plant (partly), butadiene polymerisation plant (partly),
and cis-polybutadiene rubber plant joint by Chief Engineer Mr. ZHAO

Interviewees' Office – location, condition, work spaces, furnishings etc.,

Documentations & Archival records:

Mon 29 November – Tue 30 November 1999, Documentations & Archival records survey studies at Company's
reference room.

BYPC Basic Chemical Division

Beijing Yanhua Petrochemical Co., Ltd Basic Chemical Division
Gannan Road No. 8, Fangshan District, Beijing
Postcode: 102508

Interview Contacts:

General Manager - Mr. ZHANG Chunguang
Interview 31 – 8:50–10:20 Thu, December 2nd, 1999
Follow up & Comments – 10:25-11:10 Friday, March 24, 2000

Secretary of General Manager's Office – Ms. DU Jin
Short & Focused Interview – 12:00-12:35 Friday, December 3rd, 1999

Executive Manufacturing – Mr. ZHANG Lin
Interview 33 – 14:45-16:20 Thu, December 2nd, 1999
Follow up & Comments – 15:20-16:25 Friday, March 24, 2000

Chief Engineer – Mr. HU Xuanyu
Interview 35 – 11:00-12:30 Friday, December 3rd, 1999

Executive Personnel – Mr. Liu Xiaobo
Short & Focused Interview – 9:00-10:15 Friday, December 3rd, 1999

Deputy General Manager - Mr. ZHU Jiang
Interview 32 – 11:25-12:40 Thu, December 2nd, 1999
Follow up & Comments – 12:25-13:20 Friday, March 24, 2000

Executive Marketing – Mr. WU Tao
Interview 34 – 9:00-10:25 Friday, December 3rd, 1999

Executive Purchasing – Mr. JIANG Hao
Short & Focused Interview – 11:00-11:35 Friday, December 3rd, 1999

Executive Accounting – Ms. WANG Ying
Short & Focused Interview – 14:00-14:35 Friday, December 3rd, 1999

Party Branch Chair –
Not Responded

Direct Observation:

Quarterly strategy reviewing (Winter/99-Spring/00) & Annual Summary meeting

Conference Room, General Managers Office, Thu, 16 December 1999
Contacts: Section 1 (9:00-12:00)
Lunch Break (12:00-15:00)
Section 2 (15:00-17:00)

On site Observation

Factory works – phenol-acetone plant 1 (partly), phenol-acetone plant 2 (partly) and pilot plant joint by Chief Engineer Mr. HU

Interviewees' Office – location, condition, work spaces, furnishings etc.,

Documentations & Archival records:

Thu 2nd December – Friday 3rd December 1999, Documentations & Archival records survey studies at Company's reference room.

6. 6. 3. Management Insight into the Changing Environment of Business Operations

This section first provides an introduction to the commonly adopted approach at case companies for interpreting the environmental context of business operations. It, then, provides an initial analysis on managerial perceptions commonly hold at case companies towards major changes in the environment of business operations since MES reform.

➤ Analytical Approach to Interpreting the Environment of Business Operations

The consensus of data collected both via interviews and documentations shows that case companies have adopted a characteristic way of interpreting the environmental context of business operations. The case evidence clearly indicates that there has been a range of environmental forces that generally influence business operations and its performance of large-scale SOEs in the industry. Economic, social, technological, and particularly governmental forces have been suggested by the case evidence are the most influential from an operations management point of view. The core of environmental context, as reported by the majority of managers interviewed, is market demand and industry competition. The key issue is how these environmental forces impact the market demand and industry competition, especially in terms of resultant changes regarding their level and pattern.

Managerial understanding on market demands, as many respondents suggested, is of primary importance for establishing a strategic insight into the changing environment of business operations. The analytical approach adopted for interpreting market demands is to identify key "order winners". In so doing, "competitive factors" that are "customer-oriented" and "market-focused" could be identified for business operations. Performance of business operations, as reported by case companies, is then to be assessed and relative strength and weakness identified against these competitive factors. The analytical approach adopted, as the case evidence shows, is through using the "value chain" framework and associated "activity-based theory" of business operations. The concept of the value chain, as referred to by many respondents, provides a frame of reference for thinking in competitive sense about the value activities involved in business operations and assessing their relative cost and role in differentiation. Value activities, as regarded by them, are basic units of operational performance and competitiveness in the marketplace. Competitor's performance in the segment, then, is also assessed against these identified competitive factors using the "value chain" framework. Managerial understanding on the three aspects above, as suggested by the case evidence, is then brought together through a "market attractiveness analysis". That is to assess the strength of the operations in particular market niche case companies engaged according to the long-term attractiveness therein. Through the analysis the "competitive position" that is most beneficial for the business in relation to the overall operating context has then been identified.

➤ Managerial Perceptions towards the Changing Environment of Business Operations

There have been drastic changes, as the case evidence suggested, in the environment of business operations during the ninth five-year plan period (1996-2000). Changes in market demand and industry competition, as suggests by many respondents, have been essentially government-driven in the industry and significantly influenced the management and development of business operations. The following of this section will, then, discuss managerial perceptions towards major changes in market demand and industry competition during the ninth five-year plan period (1996-2000) within the context of government's overall economic reform.

Due to the rapid development of China's economy, as reported by Mr ZHAO (general manager of Ethylene Division), there has been a huge growth in domestic consumption of petrochemical products in the downstream manufacturing of plastic and many other industries (Interview 7, 1999). For example, China's domestic consumption of plastics has grown at a compound annual rate of 12.3 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 for plastics in China significantly exceeded domestic production, with imports accounting for approximately 60.6 per cent of domestic consumption. In response, the government's ninth five-year plan for 1996-2000 called for a substantial investment in construction or expansion of six ethylene facilities in China and by the end of 2000 the total domestic production capacity of ethylene reached 4.2 million MTA. The company's ethylene facility, as referred to by Mr ZHAO, is one of the six expansion projects contemplated by the ninth five-year plan (Interview 7, 1999). Notwithstanding this development in production capacity of ethylene, as reported by Mr ZHANG (executive marketing of Ethylene Division), in 2000 there still was a shortage of ethylene 2.3 million tonnes and a serious shortage of many related petrochemical products required by the downstream manufacturing. For example, in 2000 imports accounting for approximately 79.2 per cent of domestic consumption of LDPE, 39.3 per cent of domestic consumption of HDPE, 77.9 per cent of domestic consumption of polystyrene, and 31.8 per cent of domestic consumption of ethylene glycol (The PRC Petrochemical Industry Statistical Annual Report 2001).

The level of market demand for PET resin, as reported by Mr WANG (general manager of Polyester Division), is heavily tied to the development of downstream industries that produce various film matrixes (Interview 13, 1999). Due to the rapid development of China's economy, there has been a huge boom of such downstream industries in last five years. As the result, domestic consumption of PET resin across major categories has grown at a compound annual rate of 16.7 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 for PET resin significantly exceeded domestic production with imports accounting for approximately 48.3 per cent of domestic consumption.

The market demand for polypropylene resin, as reported by Mr LIU (general manager of Polypropylene Division), has also been subject to high level of growth during the ninth five-year

plan period. There has been a rapid development, as referred to by Mr WANG (executive marketing of Polypropylene Division), in the downstream industries that manufacture fibre and copolymer matrix. For example, there has been a huge growth in demands of chemical fibre carpet during the ninth five-year plan period due to the rapid development of urban living standard and domestic decorating consumptions tied to the vast amount of upper-class construction projects such as hotels, business centres, and office buildings. Data collected at Yanshan's chemical fibre carpet division via both interviews and archive records has strongly supported this overall picture of growing market demand. Overall demand in year 2000 for polypropylene resin has significantly exceeded domestic production with imports accounting for approximately 47.4 per cent of domestic consumption (The PRC Petrochemical Industry Statistical Annual Report 2001).

The case evidence from Synthetic Rubber Division and Basic Chemical Division has also strongly supported this view. China's domestic consumption of synthetic rubber across two major categories has grown at a compound annual rate of 15.5 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 exceeded domestic production with imports accounting for approximately 40.6 per cent of domestic consumption (Import-export Information of Products of the Chemical Industry 2001). China's domestic consumption of basic organic chemicals has grown at a compound annual rate of approximately 13.7 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand in year 2000 exceeded domestic production, with imports accounting for approximately 40.8 per cent of domestic consumption (Import-export Information of Products of the Chemical Industry 2001).

Prior to 1994, as the case evidence shows, the prices and distribution of many of petrochemical products were subject to government control. Since 1994, the PRC government has been gradually lifting price and distribution controls on major petrochemical products and permitting an increasing number of these products to be priced and purchased according to market mechanisms. During the ninth five-year plan (1996-2000), as reported by many managers at the case companies, most of the principal products in the three segments were permitted to be sold according to market demand and at prices set by the market. In broad terms, China's ongoing programme of economic and market reform has developed an increasing free market mechanism for production organizations in the industry in terms of operation and competition. The introduction of the free market mechanism, in the view of managers interviewed, has resulted in heightened market competition in the industry among domestic producers over the past five years. In addition, the Fifteenth CCP Congress in 1997, decided that the state would "let go" of most under performing SOEs, leaving them to be sold off, merged, or allowed to go into bankruptcy as the market competition and business performance dictated. In concert with this the emerging free market mechanism helps pointing to a cure of the extremely inefficient capital and resource allocation under the centrally planned system, especially in terms of the vast amount of soft subsidizations enjoyed by under-performing SOEs. As a result, according to industry survey

data, the petrochemical industry has become much more concentrated with high performing enterprises over the past five years (The PRC Petrochemical Industry Statistical Annual Report 2001). In turn, the majority of managers interviewed at case companies considered intensified market competition as a much needed impetus and opportunity for the further development of high-performing enterprises in the industry.

The pattern of market demand, suggested by the case evidence, has emerged to be dynamic in nature also in line with the increasing development of a free market mechanism during the ninth-five year plan period. Because imports constituted substantial portions of PRC domestic consumptions for petrochemical products in all three segments, prices for these products in the PRC domestic market have fluctuated substantially in concert with international prices. The major concern of market demand, as the case evidence shows, has also been subject to the influence from foreign products since the Open Door policy and market-oriented economic reform. During the ninth five-year plan period it has evolved gradually from low price, availability and continuity of product supply to increasingly discerning and demanding about quality according the recognition widely shared by managers interviewed at case companies. The requirements for high quality, in the view of managers interviewed, have covered the full range of perceived value of products and services. That means customer requirement and satisfaction have gone far beyond the merely concern of conformance quality of product towards increasing concern for quality of reliability, and more and more towards perceived quality standard of the manufacturer in accordance with international standard accreditation. More recently, as many managers suggested, there has been a fast emerging trend of demands for the quality of supply serviceability and widely spread requirements for Just-In-Time delivery from downstream industrial customers. In addition, there has also been a growing demand for improvements in performance quality of products from standard index of origins to specialised index of modifications towards upper market.

For example, in the past five years, as reported by Mr ZHANG (executive marketing of Ethylene Division), there has been a fast growing demand for LDPE with high performance index of corrosion resistance, tear resistance, chemical stability, and insulating ability, which is capable of producing cable insulation for specialized purposes such as for underwater, tunnel, and laboratory usages (Interview 10, 1999). PET chips with high performance index of purity, dust content, thermal stability, and dyeing ability, as referred to by Mr LUO (executive marketing of Polyester Division), has also been subject to a fast growing demand from downstream manufacturers engaged in producing finished film matrix for specialized medical and military usages (Interview 16, 1999). There has also been a huge and fast growing demand from downstream manufacturing, as mention earlier by Mr WANG (executive marketing of Polypropylene Division), for polypropylene resin with high performance index of tensile and fire resistance for producing chemical fibre carpet. Polypropylene resin with high performance index of brightness and impact strength has also subject to growing demand in the past five years from downstream manufacturing for medical and automobile purpose (Interview 22, 1999).

Foreign products, as admitted by many managers interviewed, have comparative advantages to domestic products in terms of perceived value in the view of downstream customers particularly regarding quality factors. Historically the centrally planned quota system effectively detached the domestic production organization from its customers, and the priority for business operations has been producing the quantity required for the "state", who will guarantee purchase up to the set quota and further distribute them to downstream. Little attention has been paid to assuring product quality and other factors to the full range of customer requirements and satisfactions downstream. Over time it has resulted in a legacy of limited knowledge and capability concerning quality management and improvement of business operations. During the ninth five-year plan the entry barriers of tariffs and quotas, as well as the restrictions on foreign exchange, have been reduced in the industry. Average petrochemical and polymer tariffs, as a result, have been reduced from 23 per cent in 1996 to 15 per cent in 2000 and will further drop to 10 per cent in 2005 according to SINOPEC's annual review 2002. Lower entry barriers have encouraged more and more foreign competitors to participate domestic market in the past five years. Overtime, as widely recognized by managers interviewed, foreign products have become more and more affordable and desirable to domestic customers. In turn, it has presented a growing threat to the traditional high volume, low cost production of domestic manufacturers in the industry.

In order to operate profitably, as many respondents argued, SOEs in the industry have to progressively transform from centrally planned production unit that is only responsible for producing as much as cheaply as required by state quota to a market-oriented modern enterprise that is responsible for managing the business operations competitively to the full range of customer requirements and satisfactions particularly in the quality sense. The key "order winners" for market demands, as documented in the case evidence, are "competitive price" compared to foreign supplies, product availability and continuous supply, high conformance and reliability of product quality, scope of product performance index, flexible and reliable delivery, and quality standards.

Taken in aggregate, operating context of case companies' present huge opportunities in "high volume low cost production" and "high supply quality differentiation" in which they have established advantages among domestic producers and strength for continuous further improvements. The strategic objective in attaining such competitive position, as referred by the case evidence, is to develop and improve long-term supply partnership with downstream industrial customers, which, over time could establish a viable and sustainable customer base. Further through an "importance-performance" analysis, as the case evidence shows, management has identified improving scale economies, operating efficiency, technological advancements and product quality, product mix, delivery performance as important operational priorities where performance improvement is needed to compete with foreign competitors. These were encapsulated into the case companies' defined "competitive priorities" for business operations, which are the "simultaneous pursuit of cost competitiveness and quality differentiation".

The above managerial consensus at case companies regarding the changing environment of business operations is to be well demonstrated by the following extracts from the interview transcripts with Mr YANG (deputy general manager Polyester Division):

“...Living standard and life style in China’s urban area has improved very much in the past five years. People gradually had more money to spend on weekend breaks and public holidays As the result, the average household spending on photo filming per year, according to statistics from the government, has increased more than four times (in the past five years). More significant than increase in quantity consumed per household overtime, has been the growing consumers’ requirements in (quality of) performance and reliability especially image (perceived quality) of the film...

... It does not mean that price becomes a less concerned factor of purchasing... After all, we are still living in a developing country and low price and economic value are still and always (will be) the key consideration of consumers (in China). However, if you spent a lot of money on your holiday trip ... you don’t want just to save little money on the films bearing the risk that all your happy memories could be wasted. I won’t... Overtime, these changes in the perspective (of end-consumers) had passed on the value chain all the way up to our (downstream) customers and then to us. Foreign brand films had been always the preferred choice and increasingly became more so with the fast development of a free market environment. They’re (getting) cheaper all the time due to many factors. People’s life (in China) is also (getting) better all the time. However, adding these two together, in fact, the life of domestic film manufacturers’ downstream particularly household filming commodities is (getting) worse all the time... In earlier 1990s there were at least five or six domestic brands film nationwide, but now I think only the “Lekai (Lucky)” brand film has survived the changes happened...

...Our life as supplier of principal raw material (to them), in fact, has been (getting) more difficult overtime as well. Scale economies and cost advantages are still essential to compete in the China as I said earlier, but not sufficient any more... If we want to survive and operate profitably, especially in a longer-term, we have to keep lowering the cost and in the meantime put more quality into the product and service. Currently we could hardly compete with foreign rivals on the product quality and performance, especially perceived value of product. The gap of quality and image between domestic and foreign products would need a long-term continuous improvement to fill up. However, in term of supply quality and service, currently we do have some advantages compared to foreign rivals such as, with order lead time, order schedule flexibility, and delivery speed and reliability. This is the focus of our quality improvement, which is mainly to do with the organization and control of operations, in other words, managerial skills... Changes in the business environment required us to change responsively the way in which we manage our operations and avoid the threat (emerged) and exploit opportunity (emerged) to the full. It is the way to survive and grow.”

6. 6. 4. Manufacturing Strategy

(i) Brief description of manufacturing operation and its performance

➤ Ethylene Division

Ethylene Division has six sets of major production plants and four sets of packaging facilities. Ethylene facility processes the cracking feedstock to produce ethylene, which used as essential raw material for its LDPE facility, HDPE facility, ethylene glycol facility, and styrene facility. LDPE plant further processes ethylene through compression, polymerization, separation, pelletizing to produce LDPE. HDPE plant further processes ethylene through slurry polymerization, mixing, and pelletizing to produce HDPE. Ethylene glycol plant further processes ethylene through oxygenation, concentration, rectification, and water absorption to produce ethylene glycol. Styrene plant uses ethylene and benzene as its feedstock, aluminium trichloride as the catalyst, through alkylation and dehydrogenation to produce styrene. Polystyrene plant further processes styrene through catalytic initiation and heat initiation to produce polystyrene resins. Production system at ethylene division, as reported by Mr BI (Chief Engineer), is a highly integrated network of operations with essential three stages (Interview, 11, 1999). Production Performance of the company since the MES reform (1998-2000) is presented with Table 6.18 - Table 6.22, which are included in the Appendix G.

➤ Polyester Division

Polyester Division, as referred to by Mr LI (Executive Manufacturing) and Mr DONG (Chief Engineer), is a highly integrated four-stage network of operations (Interview 15 and 17, 1999). Xylene production feeds oxidation production which feeds condensation polymerisation production which feeds packaging and distribution operation. Xylene plant takes terephthalic acid and ethylene glycol as feedstock to acquire MX. Oxidation plant takes MX as feedstock, acetic acid as solvent, by medium-temperature catalytic oxidation to produce crude PIA, then through hydrogenation purification to produce purified PIA. The condensation polymerization plant takes purified PIA and ethylene glycol as feedstock, antimony acetate as catalyst, through direct esterization and continuous condensation polymerization to produce PET, which then follows underwater pelletization and drying to produce standard PET chips for packaging and ex-works. The HIV PET plant takes standard PET chips as feedstock to produce specialized PET chips with high viscosity between 0.74 to 1.06. Production Performance of the company since the MES reform (1998-2000) is presented with Table 6.23 - Table 6.27, which are included in the Appendix G.

➤ Basic Chemical Division

Basic Chemical Division has two major sets of production plants and five sets of packaging facilities. Phenol-acetone facility uses the propylene produced by Yanhua's ethylene facility as

principal feedstock through the process of cumene synthesis and cumene oxidation to first produce cumene as by-product. It, then, uses cumene as raw material through molecular sieve catalyst, decomposition, purification and hydrocarbon recovery to produce phenol and acetone for drying packaging and ex-works. Meta-cresol facility also uses propylene as principal feedstock through iso-propyl-toluene catalyst, oxidation, decomposition and purification to produce m-cresol, p-cresol, acetone and BHT for drying packaging and ex-works. Production system at basic chemical division, as reported by Mr HU (Chief Engineer), is a highly integrated network of operations with essential two stages (Interview 35, 1999). Production Performance of the company since the MES reform (1998-2000) is presented with Table 6.28 - Table 6.32, which are included in the Appendix G.

➤ Synthetic Rubber Division

Synthetic Rubber Division, as referred to by Mr ZHAO (Chief Engineer), is a highly integrated three-stage network of operations (Interview 29, 1999). The company currently has total 11 sets of production plants and 3 sets of packaging facilities. The company's DMF extracted facility and acetonitrile extracted facility use the C4 produced by the Yanhua's ethylene facility as feedstock through oxidation, dehydrogenation, tri-isobutyl aluminium catalyst and isobutene separation to produce butadiene, 1-butene and liquefied petroleum gas. The butadiene is, then, used as a principal feedstock for the company's cis-polybutadiene facility, polybutadiene facility, and SBS facility to produce synthetic rubber in three major categories - cis-polybutadiene rubber, solution styrene butadiene rubber and SBS for packaging and ex-works. Performance of the company since the MES reform (1998-2000) is presented with Table 6.33 - Table 6.37, which are included in the Appendix G.

➤ Polypropylene Division

Polypropylene Division, as referred to by Mr SHUN (Executive Manufacturing) and Mr WANG (Chief Engineer), is a highly integrated three-stage network of operations (Interview 21 and 23, 1999). Propylene condensation facility feeds pelletization facility which feeds packaging and distribution operation. The company's production takes propylene produced by Yanhua's ethylene facility as raw material through liquid initiation process to produce polypropylene resin then follows underwater pelletization and packaging for ex-works. It now has three sets of polypropylene facilities, two sets of pelletizing facilities, one set of packaging facility. The third polypropylene production line was constructed and put into operation in 1998. Its rated capacity was 200,000 MTA, and it was the plant of the biggest single line production capacity in Asia in 2001. The gas phase production process licensed by American AMOCO Company was employed. It is one of the most advanced process technology in the world with the character of short process flow and low energy consumption. Production Performance of the company since the MES reform (1998-2000) is presented with Table 6.38 - Table 6.42, which are included in the Appendix G.

(ii) Summary of manufacturing strategy

The objective of manufacturing strategy, in the view of managers interviewed, is to configure and improve the production system and its competences in order to adequately operationalise and fully support the overall strategic perspective of business operations for achieving and strengthening long-term competitiveness of the firm. The simultaneous pursuit of “cost competitiveness” and “quality differentiation”, as reported by many respondents, requires both technically-based and managerial-based competence in production.

Technically-based production competence in cost competitiveness and quality differentiation has been developed following the ‘total productivity’ approach to continuous operational improvements adopted at case companies. The focus, as the case evidence shows, has been on technological advancement of the production process and improving task-oriented workforce skills. The goal here is to enable the production system with accumulative technically-based competences to continuously improve performance on scale economies, materials and facilities operating efficiency, labour productivity, production quality yield.

Managerial-based production competence in cost competitiveness and quality differentiation, as managers argued, lies essentially in the organization and control of the production process, which has been subject to continuous improvement following the ‘total quality’ approach adopted at case companies. The focus, shown by the consensus of managers interviewed, has been on establishing a management-led mechanism for developing cross-functional “know-how” and competences in performing team-based operations. Technically-based and managerial-based production competences, as many respondents argued, have been always managed and functioned as a whole to contribute to the long-term competitiveness of operations.

In terms of competitive priorities of production performance, as reported by the case companies, the most essential is to produce at a high level of ‘conformance quality’ before advantages on other aspects of manufacturing performance could be pursued. Conformance quality of production, shown by data, is not merely in ‘product sense’ but also in ‘production sense’. The scope of quality performance improvements, as the case evidence shows, has been ongoing in nature, which over time also has a bearing on the ‘reliability quality’ of production. The performance indexes of product have also been subject to continuously improvement effort at the case companies. At the aggregate level, such scope of management perspective in quality improvement has been termed as “total quality performance” of production. Although the initial effect for the above quality improvement may be to increase production unit cost, as shown by production data presented earlier, there has been a long-run cost reduction. This has been mainly reflected by a continuous compression of defects, reworks, on site inventory levels, and a greater utilization of production facility and capacity. Identified competitive priorities have been well documented in case companies’ statement of operations strategy:

- Ethylene Division

“Continuously improve and strengthen operations competence, take “cost” out and put “quality” in, develop strategic supply partnership with major customers!!”

Source: Ethylene Division Annual Report 1998

- Synthetic Rubber Division

“Perfecting operations management system, making cost and quality management more scientific standard and modern, promoting famous brand strategy!!”

Source: Synthetic Rubber Division Annual Report 1998

- Polyester Division

“Seize market opportunities, strengthen managerial competence, survive on product and service quality, develop on technology and technical advancement, take the customer’s satisfaction as supreme!!”

Source: Polyester Division Annual Report 1998

- Basic Chemical Division

“Strengthening technical competence, pushing forward management reform, promoting economic growth through quality and cost progress!!”

Source: Basic Chemical Division Annual Report 1998

Technically-based and managerial-based production competences, as reported by managers, have been built over a long period of time following the two overall parallel programmes to continuous operational improvement adopted at case companies. From a manufacturing perspective this has been achieved through a series of modifications and improvements consummated in three major areas - production system design, production planning and control, and operational improvement and performance assessment. Each will now be reviewed in turn.

➤ **Production system design**

The most significant modification made to the production system since MES reform, as referred to by many managers, is the improvement and redesign of work organization following the two overall parallel programmes adopted at corporate level – ‘total productivity’ and ‘total quality’ approach to continuous operational improvements.

Work organization of production system, as the case evidence shows, is essentially task oriented with defined work standardization via formal rules and procedures. Work is also highly specialized as the tasks and responsibilities of different workstations are clearly broken down. Work organization has been better programmed in concert with the introduction of advanced and integrated production technologies and the reengineering of production processes at case companies. Following the "total productivity" approach, case companies also embarked continuous technically-based training to improve task-oriented workforce competence, and technical "know-how". Labour productivity, as shown by data, has been subject to continuous improvements since 1998. As a result, personnel with technical qualification, as the case evidence shows, have increasingly become a key part of the organization (see Table 6.43). A large reduction of surplus and incompetent workforce has also been conducted across case companies since 1997. This five-years downsizing project was scheduled to be completed by 2002 with 35 per cent reduction in total full-time employees. The approach adopted for such reductions, as reported by case companies, has been essentially technically-based that worked in concert with continuous programmes of workforce improvement and performance assessment discussed above.

Table 6.43

	Ethylene Division			Polyester Division			Polypropylene Division			Synthetic Rubber Division			Basic Chemical Division		
	2000	1999	1998	2000	1999	1998	2000	1999	1998	2000	1999	1998	2000	1999	1998
Chief Engineer	5	5	4	2	2	2	3	3	3	2	2	2	1	1	1
Senior Engineer	51	36	27	14	10	7	24	16	15	13	10	10	15	14	14
Engineer	162	125	104	21	13	9	43	35	32	50	38	35	21	18	18
Assistant Engineer	364	282	257	117	79	62	160	142	127	113	97	83	188	175	167
Technical Assistant	1190	1012	966	137	106	91	378	368	329	407	395	373	282	278	262
Training Assistant	1509	1334	1297	483	380	277	504	590	579	794	785	727	441	502	466
Worker	1287	1989	2203	676	907	1144	733	978	1125	1109	1389	1587	764	990	1135
Total Employee	4568	4793	4858	1450	1497	1592	1845	2132	2207	2488	2716	2817	1712	1978	2059

Assessment result of employee's task-oriented capabilities, technical "know-how" and labour productivity, as documented in the case evidence, has been the major criteria for initial lay off decision. This has been made operational through the established mechanism of a quarterly based routine performance assessment. If the employee failed the routine assessment against the respective performance measurements for the job, there would be a warning issued and a comprehensive performance test for the job would be conducted in the next quarter. If the

employee failed again, the employment would be immediately transfer to part-time based contract status. In the mean time, the employee would receive a full-scale retraining for job. The employee then has six months before another comprehensive performance test for the job. If the employee passed the test, the employment would be transferred immediately back to full-time permanent contact. If the employee failed again, the employee would be laid off from the job and transferred to the parent company (Yanshan)'s labour pool where the employee can receive retraining for other possible jobs within the group. However, when a laid off employee in the labour pool has been unable to find suitable job within the group for two years, it is acknowledged by the case evidence that there would be a compulsory termination of employment.

The key reason for the adoption of this technically-based approach, in the view of managers interviewed, is two fold. Firstly, in truth, workforce reduction has been an often difficult task for the management, especially in China's SOEs for many social, cultural, and political constraints mentioned earlier at the out set of this chapter. Therefore, it has been essentially for the concern to make such decision based on objective, transparent, and fair ground in order to fend off political and social interference. Secondly, downsizing is, after all, only means to achieve the purpose of total productivity improvement. For it to fully contribute to its purpose, downsizing has to work in concert with continuous programmes of workforce improvement and performance assessment. However, political and social interference from the party, as many respondents reported, has undermined these two strategic initiatives of workforce reduction programme. Political interference has been always influencing lay off decisions, especially if the employee is a party member. This has, as many managers argued, negative impact on employee's perception for management's initiatives, particularly in long-term if this happens to be a continuous pattern towards lay off decisions on incompetent party-member employee.

In addition to this major technically-based approach, the management also applied a number of other methods in their efforts to achieve workforce reductions. Early retirement has been encouraged since 1998, and employees taking advantage of it can receive a lump-sum investment from the group company in order to help them start their own business.

Since the "gaige" initiative of MES reform in 1997, a major modification to the mechanistic work organization of production was made to bring in an organic control mechanism, which also enables the coordination of value activities via cross-functional liaison devices. Through this modification case companies have established a management-led cross-functional mechanism for improving workforce competences and "know-how" in performing team-based operations. This cross-functional mechanism is chaired by general manager at case companies and supervised by a coordination committee consisting of deputy general manager, chief engineer, executive manufacturing, executive marketing, and executive personnel. Overtime, it has established the outside work design for each workstation within the production system. That is, as referred to by managers interviewed, additional duty for each workstation in participating cross-functional improvement groups and quality teams established at shop floor level.

By year 2000, more than 1500 technical personnel have gone through such team-based training scheme and became cross-functional task force at case companies. Case companies' pilot plants, as referred to by managers interviewed, has provided a full-scale simulation base and contributed significantly to the above team-based cross-functional training mechanism. The focus of training is on cross-functional "know-how" and competences in facilities online maintenance and failure recovery. Such team-based training mechanism and improvements in workforce competence, as reported by many respondents, has contributed significantly to the success of those major technical modification projects discussed earlier during the ninth five-year plan period.

➤ **Production planning and control**

The most significant modification made to the production planning and control system since MES reform has been the introduction of Materials Requirements Planning (MRP) to replacing the centrally planned production quota and resources allocation system. The objective is, as documented in the case evidence, to assist with the reconciling between production and demand at aggregate level particularly for longer-term production scheduling and raw material purchasing. Major elements included in this MRP system are the annual demand forecasting and capacity planning and the computerised production requirements planning and scheduling.

Annual demands forecasting and capacity planning, as the case evidence shows, have been conducted following a three-step method. An initial forecast on the annual demands is first conducted based upon statistical analysis of the general market information provided by SINOPEC data centre. Such initial forecast of demands provides the basis for case companies to organize their annual sales conferences in February to market its products to major customers with established supply partnerships. The majority of case companies' sales were arranged at such sales conferences pursuant to annual sales-contract, which contracts generally specify annual quantities of products to be provided and an initial supply schedule but allow batch size, order prices, and delivery time to be determined from time to time according to market conditions. In May and July each year, sales and marketing personnel attend annual petrochemical products trading conferences held by the PRC internal Trade Bureau and SINOPE at which case companies generate the rest of orders from customers throughout the PRC.

Based on the above annual demand and distribution information of the finished products, as reported by case companies, a computerised control and information system then provides a formal plan for purchasing feedstock and raw materials of particular types that are needed and for scheduling production works that are involved. This formal plan, as referred to by managers interviewed, is documented in the form of case companies' quarterly-based production schedule which generates material plans, purchase orders and work orders. Deployment of this

computerised information and control system, as shown by the case evidence, has been an important element during the construction of case companies' MIS discussed in the previous section. In fact, as many respondents reported, it has been on top of the agenda of case companies' technically-based 'total productivity' programme of continuous operational improvements. The software package of this system, as shown by the case evidence, is self developed by SINOPEC in 1996 and currently used by all its major domestic subsidiaries. During interviews, some respondents have briefly presented the major functions of the software package. In short, the system adopts a Reorder Cycle Policy, which generally specify purchasing schedule of feedstock and other raw materials within an average time intervals of 10-13 weeks. Work schedule are derived from average setting parameters of production such as, product price, costs of supply, order lead-time, delivery time and inventory holding costs. The software package is based on one integrated system containing a production database, which is accessible and used by the whole operations network according to their functional requirements. The bill of materials and inventory status is held in the purchase function and updated on an ongoing basis with changes made elsewhere in the network such as, production, engineering and finance functions.

This MRP system, suggested by the consensus of managers interviewed, is essentially market-oriented and has significantly improved the management and control of purchasing load and supply network. It has also, as reported by many respondents, contributed significantly to the improvement of cost competitiveness of business operations through lowering purchase and order costs of major feedstock particularly through using forward contracts.

However, as stated earlier, domestic demands are dynamic in nature. Prices for products fluctuate substantially in concert with international prices. There has also been a fast growing requirement for Just-In-Time delivery from downstream industrial customers. Therefore, there has been huge difficulty in achieving the data accuracy of forecasting demands beyond aggregate level. From the past experiences, as reported by many respondents, discrepancies between planned production schedule and actual demands have been, in large extent, inevitable. A major modification of production planning and inventory control system has been conducted in early 1998 to bring in Just-In-Time pull mechanisms on a day-to-day basis for the "real-time" control of material flow and production process. The principle of this JIT-pull system is an inventory-based control philosophy of material flow. Following this philosophy inventory is seen at case companies not as an asset, but as waste. Excessive inventory levels and buffer stocks are seen as unnecessary excess, hiding underlying causes of root problems in the productions system and operations network, especially in a quality sense. Implementation of JIT at case companies, as suggested by the consensus of managers interviewed, has played a key role in managing the production process with greater synchronization and asset parsimony. Since the adaptation of such JIT-pull control system the financial hungry inventory of finished products has been gradually reduced to one third of the average stock level required previously by centrally planned inventory system and the standard stock level of Work-In-Progress have also been reduced from

original 10 days of production requirements to only 3 days now (Business Statistical Yearbook of Yanshan, 2000).

➤ **Operational improvement and performance assessment**

Under the “gaizao” initiative of MES reform there has been a series of major technical modification projects conducted at case companies during the past five years. Modifications of ethylene facility, LDPE facility, polyester facility, and polypropylene facility, in the view of managers interviewed, have been the most significant among them in terms of technological advancements and capacity expansions achieved in production. It is also evident that there has been a great deal of managerial attention concerning the production network as a chain of synchronized manufacture and a strategic perspective of managing synchronization of productivity and quality yield within the production network.

The leading project, as reported by managers interviewed, is the technical modification of ethylene facility during 1998-2000. Using self developed technology, the modification has successfully increased rated production capacity from 450,000 MTA to 660,000 MTA and developed the technological ability first among domestic producers to use cheaper cracking feedstock substitute without compromising production efficiency and quality yield. In 1998, 1999 and 2000, the amount of less expensive cracking feedstock substitutes used by the company accounted for approximately 28.0%, 29.0% and 30.0%, respectively of the company's total cracking feedstock consumed. In order to fully exploit from a network perspective the improved scale economies and achieved technological advancements of the ethylene facility, parallel modification projects have been conducted for the LDPE facility, ethylene glycol, and HDPE facility during the same time between 1998 and 2000 at Ethylene Division. The modification project of LDPE facility successfully increased rate production capacity from 180,000MTA to 390,000 MTA and improved the operating efficiency and quality performance of the facility with imported technology from ABB Lummus Crest Inc (USA). Overall, across its major production facilities, the company is currently the most efficient among domestic producers in terms of material conversion rate, energy utilization, and capacity utilization (SINOPEC Economic Information, 2001). It was also the first among domestic producers achieved in extending the time between its scheduled plant shutdowns for facilities maintenance from two years to the current three years (Business Statistical Yearbook of Yanshan, 2000).

In order to utilise the additional propylene to be produced following the expansion of ethylene facility, polypropylene facility is modified in 1998 through which the rated production capacity has been significantly increased from 115,000 MTA to 455,000 MTA. Using advanced technology imported from America the modification project has also improved production efficiency and achieved a leading position among domestic producers. Quality performance of the production

has also been improved via the modification, which enabled Polypropylene Division to become the first among domestic producers that is capable of producing modified polypropylene resin with high impact strength for automobile purpose.

The strategic perspective of managing synchronization within the production network during technical modifications has also been well demonstrated at Polyester Division both within the company and as part of the entire production network of Yanhua. Management practices at Polyester Division also provide insight on the way in which improvements in team-based cross-functional "know-how" and competences discussed earlier contributed to the success of its modification projects. Of special note is the accumulated technical and managerial "know-how" and competences developed within its workforce, particularly with cross-functional in scope.

In order to fully exploit achieved technological advancements of the ethylene facility and utilise the additional ethylene glycol to be produced, Polyester Division has conducted a series of facility expansion and technological advancement projects during the same period between 1998 and 2000. Considerable investment, as shown by data, has been committed. The leading project, as referred to by Mr LI (Executive Manufacturing), is xylene plant's modification in 1998 (Interview 15, 1999). In March 1998, during scheduled plant shutdowns for maintenance the company cooperated with UOP (USA) and modified its para-xylene plant (PX) to meta-xylene (MX) production using full-scale imported technology with self-design. This modification of the xylene plant increased the rated production capacity from original 30,000 MTA to 40,000 MTA. More important, as referred by Mr Dong (Chief Engineer), this modification significantly improved the production capability for producing MX with greater energy and raw material efficiency and with higher quality of performance (Interview 17, 1999). Modified MX plant takes terephthalic acid and ethylene glycol as feedstock, uses hydro-isomerization and simulation movable bed adsorption separation process, which is capable to acquire over 99.5% purity MX. Such technological and quality achievement is currently, as referred to by Mr Dong, the most advanced among domestic producers and of leading position in the industry. In order to fully exploit from a network perspective the achieved technological advancement and improvements in productivity and quality yield of its xylene facility, the company also conducted a series of parallel modification projects for establishing the synchronization within its chain of production. During the modification project, xylene plant's improvement group across all workstations worked closely with foreign experts from UOP in order to absorb and transfer the "know-what" about the imported advanced process technology into the "know-how" on improving productivity and quality yield of production. The company's established cross-functional task force was deployed in the meantime across three production plants to transfer the advanced "know-how" from xylene production into forces of 'technical pull' for the rest of the production chain to synchronize with improved productivity and quality yield. At the time the central focus of synchronization effort, as referred by Mr LI, was on preparing oxidation plant's modification because of its emerging bottle-neck status within the production network (Interview 15, 1999). Oxidation plant's improvement groups have been working closely with the cross-functional task force and the company's engineering and R&D

department on the development of its modification plan. Through five months continuous cross-functional efforts, the technical modification plan for oxidation plant passed full-scale simulation test in the pilot plant only three months after the completion of xylene plant's modification project. In August 1998 oxidation plant's technical modification took less than one month for its completion with self-developed technology and successfully increased the rated production capacity from original 30,000 MTA to 40,000 MTA. The modification also enabled the oxidation production process to adequately reflect and fully exploit improved productivity and quality yield in the upper chain of xylene production and forward them to the next stage of condensation polymerization production in the production network.

Another major aspect of operational improvements during the ninth five-year plan (1996-2000) has been the implementation of a Total Quality Management (TQM) programme in addition to case companies' established statistical approach of quality inspection and control. The objective is, as shown by the case evidence, to gradually evolve the focus of quality management from the "product quality of conformance through inspection-in" to the "total quality of production through design-in and prevention".

Customer requirements and satisfaction surveys have been conducted twice a year since the initiation of TQM in which production function has participated and played an increasing key role. During the interviews, some respondents presented a profile of questionnaires used in these surveys and explained thoughts behind the design and refinements overtime. In short, the overall objective is to increase the company's market awareness and knowledge concerning trends in demands particularly from its production core. Information collected through these surveys, in the view of managers interviewed, has helped the production system to see things from the customer's point of view and increasingly see the importance of "quality", both in product and production sense, as the key "order-winner" for demands and therefore of important strategic concern. Production system has installed the mechanism of 'internal customer and supplier' to cover all parts of it into the TQM programme. The concept of 'internal customer and supplier', as referred to by many respondents, was used as the vehicle to change the attitudes and beliefs of employees to recognize that errors and quality issues would eventually pass through the internal supply chain and reach the external customers.

Since 1998 through the established team-based cross-functional training mechanism discussed earlier, a continuous programme of quality improvement has been conducted to improve and further strengthen the "quality" of value adding activities. Working in concert with the above, the management of production has also developed a multidimensional performance assessment system in order to measure the quality improvement progress. That is to applying the combination of three sets of quality measurements – product measure (product's conformance, performance, reliability, etc.) production measure (facility's conformance, performance, reliability, etc.) and human-based competence measure (worker's conformance, performance, reliability, etc.). In order to formally assess the overall quality improvement progress, case companies have been

constantly working towards attaining international standard accreditation for their quality management and assurance procedures. ISO 9002 deals with quality systems model for quality assurance in production and installation operations of which has been commonly regarded as the benchmark at case companies because it would signify an achieved and sustained standard of "quality management practice" comparable with their accredited foreign competitors.

Ethylene Division was the first at Yanhua acquired the ISO9002 quality certification in 1997 and followed by Polyester Division in 1998, Polypropylene Division in 1999, and Synthetic Rubber Division in 2000. However, caution has also been widely expressed by managers interviewed at case companies that such accreditation should only be regarded as a means for assessing and benchmarking quality assurance procedures deployed to improve the total quality of product/service provision rather than a "goal" in itself. Many managers argued that the procedures and, in particular, documentation demanded by the accreditation was bureaucratic in nature. The physical existence of such documentation does not necessarily mean that these procedures have been followed. Of special note is the critique widely expressed by manufacturing executives and chief engineers at case companies that given the complexity of the production processes the majority of the outside external auditors do not readily understand the operation.

6. 6. 5. Business and Manufacturing Strategy Process

The development, reviewing, and modifying of business strategy and other functional strategies including manufacturing strategy, as the case evidence shows, mainly take place at the company's quarterly strategy review meeting, where operational performance is reviewed and strategic issues are addressed. Management's strategic perspective towards operations and operational improvements at case companies, in the view of managers interviewed, is mainly formed and reviewed during this meeting. The author had the opportunity under the arrangement by Mr. DU (CEO of Yanshan) to observe the strategy review meeting at case companies for the third quarter of 1999 (See Figure 6.19 for details).

Figure 6.18 Observation of Quarterly Strategy Review Meeting

Ethylene Division

Conference Room, General Managers Office, Tue, 14 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

Polypropylene Division

Conference Room, General Managers Office, Friday, 17 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

Basic Chemical Division

Conference Room, General Managers Office, Thu, 16 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

Polyester Division

Conference Room, General Managers Office, Tue, 21 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

Synthetic Rubber Division

Conference Room, General Managers Office, Friday, 24 December 1999

Contacts: Section 1 (9:00-12:00)

Lunch Break (12:00-15:00)

Section 2 (15:00-17:00)

By triangulating together the case evidence from observation data, interview data and documentation data the author has developed useful insight into the actual strategy process at case companies, which organized around the six essential facets of investigation defined in the framework of analysis (see Chapter 4 section 4.3.1). Each will now be reviewed in turn.

- Organizational Involvement

The meeting is commonly chaired by the general manager of the company. Other management personnel of the company are present at the meeting including:

Chief Engineer	Deputy General Manager
Executive Manufacturing	Executive Marketing
Executive Personnel	Executive Purchasing
Executive Accounting	Secretary of General Manager's Office (Non-executive member)
Party Branch Chair (Non-executive member)	Secretary of the Trade Union (Non-executive member)

Prior to the meeting (normally one week), each functional executive was required to submit a quarterly reviewing report, which contains four major elements:

- (i) Updates on major changes occurred in its functional conditions and capabilities since last quarterly report, especially in terms of changes regarding "cost" and "quality" performance in a competitive sense;
- (ii) Updates on major changes occurred in its respective external environment (e.g. executive personnel – changes in labour markets; chief engineer – technology markets) since last quarterly report;
- (iii) Taken in aggregate, updates on major changes and emergent trends in its respective operating context (internal & external);
- (iv) Analysis on the above changes in relation to the overall operating context of the company and pointing out possible strategic implications for the management of its function and company's business operations in general.

A quarterly reviewing report is also required from the coordination committee that supervises the company's cross-functional improvement mechanism. This report is normally drafted by the deputy general manager of the company, which provides a review on team-based training activities in the last quarter and updates on current status of the company's cross-functional task force.

Submitted quarterly reviewing reports, as the case evidence shows, were, then, prepared as proceedings of the meeting. This prior meeting procedure is overseen by the secretary of general manager's office at case companies.

- Managerial Leadership

Managerial leadership has been singled out by case companies as the most significant aspect in reflecting a changing paradigm of strategy process over the past five years into the MES reform and share holding system restructuring. This has been well demonstrated through the role played by general managers and functional executives during the strategy review meeting.

During the meeting, functional executives present their reports and answer questions from others. The majority of questions, according to the observation, were from other functional executives. Indeed, functional executives have been playing a very active role during the presentation and often provide useful comments during the discussion. General Manager has been mainly playing the role of "facilitator" during the presentation and discussion. At the end of section one, deputy general manager presents quarterly report from the coordination committee at the company regarding the overall situation with the operations competence development and progress on cross-functional improvements. At the end of this report there is a proposal for the new strategic direction of business operations and the refinement of strategic perspective towards operational improvements. In this proposal, first, it draws together those functional-based updates into a perceived new "vision" of the overall operating context and highlights constraints and impetuses derived from those major changes since the last quarterly review; second, it suggests a possible way to reconfigure the management policies of business operations system to adequately reflect and fully exploit those constraints and impetuses so as to strengthen the company's competitiveness. After the presentation there is a lunch break and the meeting is continued after the break with free discussions on the "proposal".

According to the observation, in fact, the majority of discussions happened during the lunch break among functional executives and between executive members and non-executive members namely Party Branch Chair and Secretary of the Trade Union. It is evident that there are different interest groups among managers at case companies particularly between executive and non-executive members. Political processes of bargaining, negotiation and compromise between different interest groups have been also evident during the discussion. However, the most predominant difference, according to the observation, was revealed between the political interest of the Party and operations concern of the organization. For certain issues, especially those regarding policies on personnel selection, different views between political interest and operations concern have been argued intensely. This is because, as suggested by some managers interviewed, such issues have important implications for the status or influence of different interest groups in the organizations. This difference has been resolved during discussions mainly through a social process of mutual

adjustment of which general manager's role as a "facilitator" has been significant according to the observation. Although intensive arguments do occur, according to the observation, managers at the meeting seem quite prepared and used to such situation. Almost all managers interviewed at case companies suggest that management of operations in the context of SOE cannot be conceived simply in terms of the manipulation of managerial techniques or tools of analysis. Management is also about the application of social and managerial experience built up over many years in such a power-political environment of the organization. At case companies, in the view of managers interviewed, these have been encapsulated into collective perceptions and procedures established in strategy development process over time as "the way they do things around there". The meaning these collective perceptions provided allows a shared interpretation of reality among different interest groups while procedures and social interactions establish the ground for operation. These management routines are employed to fulfil strategic tasks, such as monitoring the environment, identifying problems, producing information, and generating solutions. However, it is also clear from the observation that autonomy to make strategic decisions at the firm level is restricted by the framework imposed by outside agencies, such as strategic objective at corporate centre, corporate policy of parent company (Yanshan), government reform initiatives, political ideology etc. These have been discussed earlier to a great extent at the industry, group, and corporate level in the case study report (see section 6.2 - 6.5).

- **Planning Anchor and Decision Aids**

During the presentations, according to the observation, it is clear that the reviewing report prepared by functional executives is developed through systematic information collection and analysis following a standardised planning procedures commonly adopted at case companies. There has been a common set of analytical tools applied during the report to assist with interpreting information and determining options which have been discussed earlier (see section 6.6.5). At the end of the each reviewing report/presentation, there has been often an explicit strategic implication recommended for the management of business operations in general and management of its respective function in particular.

However, majority of managers interviewed suggest that these analytical steps involved do not unfold following a linear progression. The empirical process is more complicated with analysis, formulation and implementation activities going on all the time, thoroughly intertwined with one another. Managing strategy development merely through linear, rational, and sequential planning mechanisms, in the view of managers interviewed, is unrealistic.

Many respondents argued that, given the complexity of organizations and the environment in which they operate, managers of SOEs cannot consider all possible options in terms of all possible futures and evaluate these against preset objectives. This is particularly so in an organizational sense in which there are so often to be conflicting views, values and power bases as just discussed in the previous section.

Many respondents suggest that strategy development takes place at case companies by comparing options against each other and considering which would give the best outcome and most possible to implement. Majority of managers at case companies have a view of where they want the organization to be in years to come but try to move towards this direction in an incremental way which is commonly referred as the logic of 'Crossing the River by Groping the Stones'. They are, according to the observation, highly sensitive to environmental signals through constant environment scanning. They are developing and testing strategic options in a step-by-step process of experimentation and limited exposure. This mode of strategy development is not seen as the sole responsibility of top management. Functional managers, as discussed earlier, are actively involved. Through ongoing scanning, assessment and incremental refinement, changes in the environment are matched with changes in the strategic configuration of operations system. In so doing, in the view of managers interviewed, strengths of operations competence are retained as experimentation and learning undertaken without excessive risk to the organization. Moreover, this constant readjustment allows the mix of business resources and capabilities to be configured and improved in relation to the operating context. It also broadens information base available, provides a screening mechanism for information and increases the active search for opportunities not preciously defined. Majority of managers interviewed at case companies suggest that this incremental approach to strategy development makes a lot of sense because the operating context of SOEs is considered to be a continually changing influence on business operations.

- Information Flow

Pattern of information flow involved in the strategy development process, as shown by the data, is shaped by two compelling forces - deliberate and emergent, acting simultaneously from the management paradigm at case companies.

The deliberate forces, as the case evidence shows, have been well demonstrated by a common set of clear-cut and measurable criteria applied during the strategic decision-making process that transcend the specific requirements of various functions. A major task of top management as 'facilitator', according to the observation, has been to clarify decision

premises that can reduce subsequent information and decision burdens for functional executives during the strategy development process. The elimination of "noise", "fluctuation", and "chaos", as suggested by many respondents, is the paramount concern of top management here. During the strategy review meeting, according to the observation, top managers at case companies, then, adopt a hands-off rather than a hands-on one. The emergent forces, as the case evidence shows, have been also evident therein the strategy development process. This has been well demonstrated that the development of managerial understanding towards the operating context has been mainly an inductive process and begun with the vision of the individual - the functional perspective. These functional perspectives, according to the observation, have been fully expressed and acknowledged at the strategy review meeting. The concept of synergy is basic to inductive management paradigm and well demonstrated at case companies by the fact that functional perspectives have been taken into account and finally integrated into the overall management insight into the operations context. Configuration of business resources and operations competence, as case evidence shows, have been allocated in a way that encourages interaction, allowing new concepts and capabilities to develop in the most natural way possible. Top management support that moves in step with the functional executives, the cross-functional group, and the emerged strategic perspective is also evident at case companies. Greater autonomy, in the view of managers interviewed, is given to functional executives. In many cases, according to the observation, they have created meaningful information in the midst of interactive, tense relations, by testing and deepening their intuitive understanding through incremental practice.

Given the above, the actual pattern of information flow involved in the strategy development process at case companies appears to be a synthesis of two managerial paradigms – top-down deductive and bottom-up inductive. The core of this actual paradigm of information flow is the middle management of functional executives. Middle management, according to the observation, occupies a key position during the strategy review meeting. It has demonstrated the ability to combine strategic macro information and hands-on micro information. In other words, middle management is in a position to forge the organizational link between overall strategic perspective of operations management and individual operational improvements at the functional and shop floor level. Middle management, as the case evidence shows, is able most effectively on a continuous basis to eliminate the noise, fluctuation, and chaos within an organization's power and information structure by serving as the starting point for action to be taken by upper and lower levels.

- Formalization and Communication

Formalization and communication of strategy and strategic perspective has been regarded by case companies as another major aspect that reflects a paradigm change of strategy process during the past five years.

At the end of the meeting, decided modifications to the strategic perspective and management policies of business operations are presented in a closing speech by the General Manager. These modifications are, then, documented in the written format of meeting memo and disseminated among all line managers and technical specialists across the company. After the meeting, functional executives have one week to readjust and reconfigure their functional strategies in accordance with the modified overall strategic perspective and competitive strategy of business operations. However, as reported by managers interviewed, since 1994 case companies have kept pursuing the cost leadership and quality differentiation of operations. Major policies and two *parallel* approaches adopted by business operations have not been subject to major changes, although the appropriate balance between these two approaches has been modified and adjusted few times ever since. It has been widely acknowledged by many managers interviewed that a formalized and well communicated strategy has the benefit of coordinating all strategic initiatives within the organization into a single cohesive perspective for the business development. It helps to ensure that strategic consensus could be established throughout the entire organization to avoid overlapping, conflicting, and contradictory behaviour.

- Performance Assessment and Reward System

Performance of operations system and individual work, managers and workers alike, is now strictly assessed according to established "multidimensional" measurements on quality yield and unit cost. In manufacturing, as stated in previous section, this has been made operational through a quarterly based routine performance assessment working in concert with established continuous programmes of workforce competence improvement. Reward system at case companies has been also subject to major modifications since the MES reform and restructuring. Reward system at case companies has been, to large extent, in relation to work performance at least in financial terms. Performance related promotion and reallocation of managerial staffs at case companies, however, are still subject to continued direct party and government interference. This has been discussed in details from a content perspective in the previous section and is to be further analysed for its strategic implications on competitiveness of business operations in the next chapter.

6. 7. Conclusion

In the foregoing six sections this chapter had presented the ground filed investigation at Yanshan. It has demonstrated the 'within-case' preliminary data analysis on case evidence collected in the field. In order to present a holistic account of the strategic manufacturing management practices performed at case companies, this chapter is structured following an embedded layout with multiple levels of analysis.

The first half of the chapter (section 6.2 - 6.5) has provided an extensive and factual description of the petrochemical industry in China, case companies at the group level (Yanshan/mother company) and case companies at the corporate level (Yanhua). The focus of analysis here has been on the changing relationships with government, the organization, its subsidiaries, its products/production, nature of market demands and business performance in the context of GCS/MES reform programmes since 1997.

The second half of the chapter (section 6.6) has presented in great details about the actual transformations incurred at the SBU level of case companies. The focus of analysis here has been on the commonly adopted approach at case companies for interpreting the environmental context of business operations and managerial perceptions commonly hold at case companies towards those major changes in the environment of business operations since 1997 reform. It has then demonstrated how the strategic perspective of business operations is determined in light of the above and how it is further reflected by the manufacturing strategy adopted at case companies. It has further illustrated how the manufacturing strategy is implemented through a series of modifications and improvements consummated in three major areas - production system design, production planning and control, and operational improvement and performance assessment. Finally, it has offered detailed description and analysis on the process of business and manufacturing strategy at case companies and those major changes regarded by the management which reflecting a changing paradigm since the 1997 reform.

In the next chapter 'within-case' preliminary data analysis presented here is to be compared and integrated via a 'cross-case' analysis for interpreting and generalising the "facts" concerning context, content, and process of manufacturing strategy development explored at case companies

7. Cross-case Analysis & Study Results

7. 1. Introduction

Forrester and Hassard (2000, p.413) suggest that before a new management model or the refinement of existing model could be effectively tailored to the local context of SOEs, it is essential to first establish understanding about the specifics of local operating context with respect to the strategic management of business operations in general and manufacturing strategy development in particular. Therefore, in this chapter, the author is going to first present cross-case analysis on the context aspect of manufacturing strategy development because understanding the embedded context is the fundamental basis for grasping the findings on the content and process of manufacturing strategy and assessing these for effectiveness.

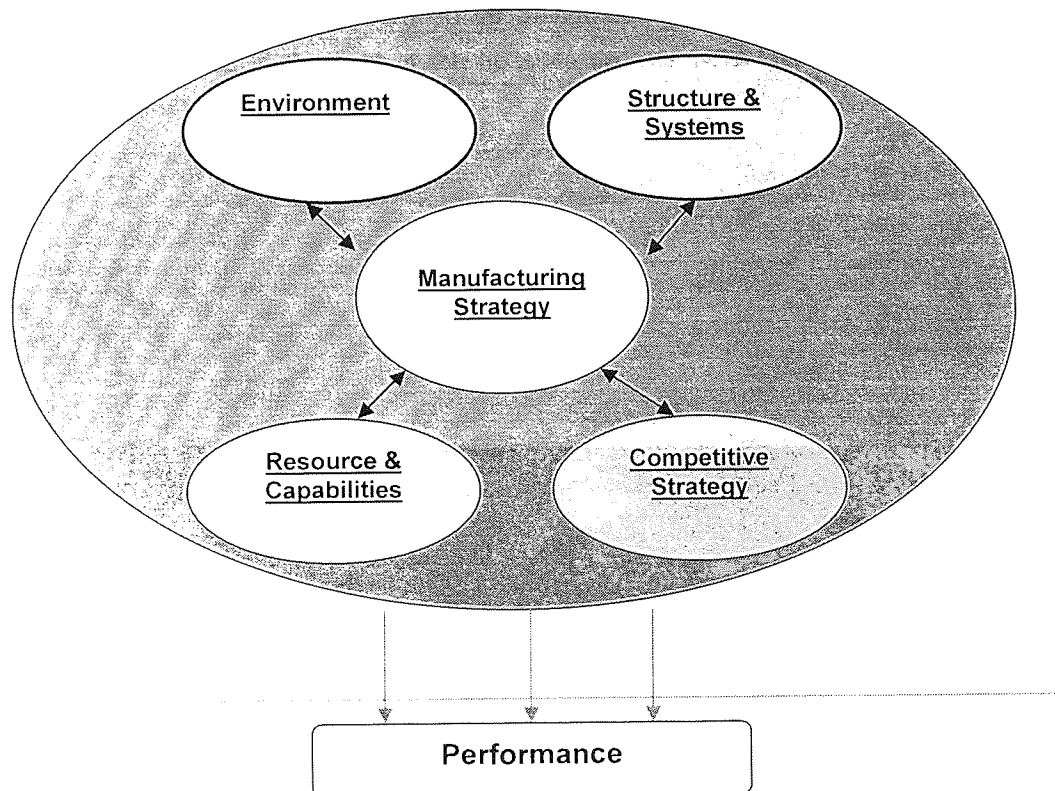
The 'context' of manufacturing strategy development is conceptualised in relation to the analytical framework formulated and presented in Chapter 4 in which four of the most critical contextual aspects of consideration are defined in the light of the literature. However, data analysis here is not only focused on examining the fact and empirical specifics of those contextual aspects above, but also focused on surfacing and conceptualising management's interpretations and perceptions of the 'fact'. Management perspective, as the central focus of investigation, was expected to have the strongest associations with operationalising business operations strategies since it is perceptions and interpretations of the 'fact' that management and decision-making act on (Bourgeois, 1980; Miller and Friesen, 1984). Thus, this part of the chapter consists of four sections. The first section examines and conceptualises the contemporary business operating context of SOEs in terms of the 'facts' - major changes that occurred, new emergent trends, and impetuses and constraints derived therein for manufacturing development. The second section examines and conceptualises the central concern of contemporary operations management at case companies, particularly in a competitive sense. As we shall see from the later analysis, the strategic perspective of business operations actually brings together managerial perceptions for the four contextual aspects defined in the literature into an overall context of manufacturing strategy. The third section, then, models managers' strategic perspective of operations management at the case companies into a configuration framework to conceptualise the overall context of manufacturing strategy development. The final section provides an empirical configuration of the overall context of manufacturing strategy structured by the above framework – an empirical typology of the strategic perspective of business operations at case companies.

'Content' and 'process' of manufacturing strategy development are, then, analysed and conceptualised within this overall context in relation to the frameworks of analysis presented in Chapter 4.

7. 2. Conceptualising the Context of Manufacturing Strategy Development

The embedded context of manufacturing strategy development is defined in the literature as the overall context of strategic manufacturing management. A conceptual framework has been developed by the author as a framework of analysis to investigate the overall context of strategic manufacturing management in which the four most critical contextual aspects in the development of manufacturing strategy have been identified from the literature (see chapter 4 section 4.3.2).

Figure 7.1 Overall Context of Strategic Manufacturing Management (as Figure 4.18)



Environment, organizational structure and control system, and competitive strategy of business operations, as Ward et al., (1996) and Hill (1994) suggest, are the most critical contextual aspects when considering and determining manufacturing strategy. Many other researchers have also offered conceptual models, which consider the linkages between the development of manufacturing strategy and the overall operating context (environmental/organizational) and competitive strategy of business operations (Miller and Mintzberg, 1983; Kotha and Orne, 1989; Leong et al, 1990; Parthasarthy and Seti, 1992). Based on these works, as the figure shows, the author aggregates resources and capabilities of business operations as another contextual aspect of the framework, as they generally influence and determine the development of manufacturing strategy (Rumelt, 1984; Barney, 1991; Grant, 1991). Through the pre-research investigation and pilot case study, the above conceptual framework was confirmed as including

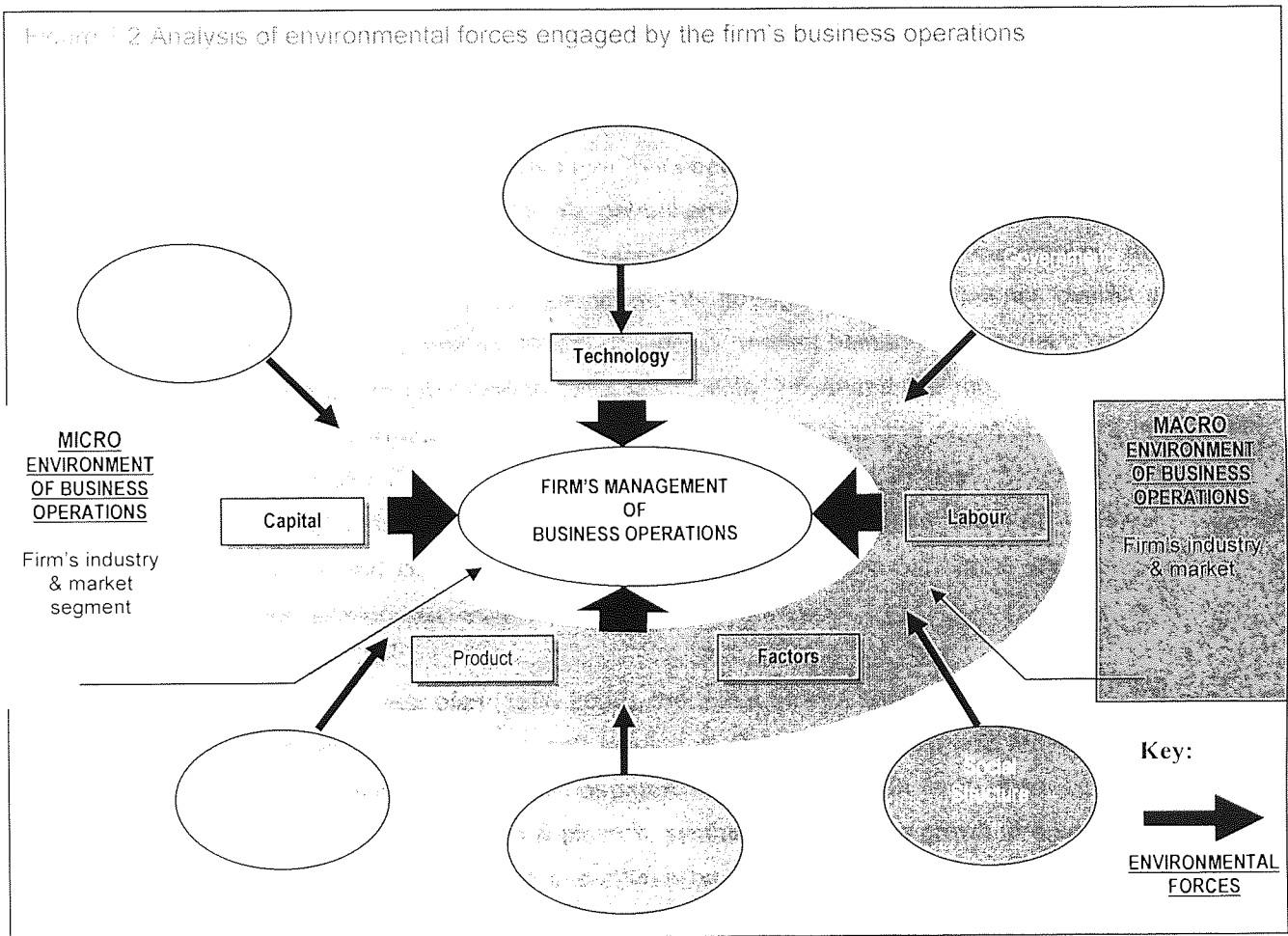
all essential aspects of the context of strategic manufacturing management practices at the case companies. It has, therefore, to a large extent, served the purpose of developing a framework of analysis to guide the research. Following this track, the research has investigated in depth the empirical specifics and managerial perceptions for each of the above four aspects, especially the way in which they interact and function as a whole at case companies. The research in the field has been conducted sufficiently openly for the best possible exploration of the locally embedded specifics and relationships of the phenomenon.

Research findings, then, have been further conceptualized into a configuration framework for defining the overall context of manufacturing strategy development. Later in the concluding chapter, a theoretical profile of the configuration framework has been compared with the one advocated by the existing paradigm. In so doing, theoretical implications of the researching findings are discussed in the light of the possible development to the subject knowledge (see Chapter 8 section 8.2.2).

7. 2. 1. Conceptualising the Context of Business Operations

➤ Environmental Context

Perceiving and interpreting environmental forces in the external operating context, as revealed from case companies' experiences, have followed the framework presented in figure 7.2 in which analytical information on environmental forces is collected and organized by their sources (economic, social, political, etc.) proximity (macro/micro) and along the time horizon for both changes occurred and emerging new trends.



The macro environment comprises the whole range of the economic, social, political, and technological forces that generally influence a firm's business operations and its performance. However, as referred to by managers interviewed, the core of the macro environment for a business is its industry and market. The key issue, as they suggest, is how these more general environmental forces impact the firm's industry and market environment, especially the level and pattern of demand and industry competition. There are five major aspects where impact from general environmental forces have been reflected in market demand and industry competition –

technology aspect, labour aspect, factors aspect, capital aspect, and product aspect. Within the macro environment, firms also have their microenvironment with business-related market and industry segment. Parameters in the macro environment provide the big picture for making sense of the specific environmental forces the firm engages in its business operations. Microenvironment parameters locate the firm's operations in the "big" picture by specifying the market demands and industry competitions it engages and specifying the impact of macro environmental forces on business operations

The case companies, as data shows, have all adopted systematic approaches to collect international/domestic market and industry information at both macro and micro level. This has been mainly conducted via direct access to Yanshan's and SINOPEC's data centres. In addition, they have all conducted systematic market research in their respective segments to obtain primary information on emergent trends in their markets.

The case evidence clearly indicates there have been drastic changes in the macro environment of business operations within China's petrochemical industry during the ninth five-year plan (1996-2000). The majority of these changes, as reported by case companies, have been government-driven and made operational mainly through PRC government's overall economic and market reform programmes. Macro changes in market demand and industry competition, in the view of managers interviewed, have significantly influenced the management of business operations and presented many impetuses and constraints to the development of large-scale SOEs in the industry. These impetuses and constraints have manifested themselves to different extent according to the specific microenvironment of the firm's business operations. However, the same impetuses and constraints have been significant at the aggregate level, which will be singled out for detailed discussion here.

During the ninth five-year plan (1996-2000), there has been a rapid development of the domestic economy at macro level after the soft landing of China's economic and market reform. As a result, China's domestic consumption of petrochemical products in three major categories (basic organic chemical products; resins & plastics; synthetic rubber) has grown at a compound annual rate of 16.7 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report 2001). Overall demand has exceeded domestic production for five consecutive years since 1996. A significant number of managers interviewed believed that domestic demand of petrochemical products would continue to grow at a rapid rate and continue to outstrip domestic production capacity for the foreseeable future.

In broad terms, China's ongoing programme of economic and market reform since the 1980s has aimed at developing a free market mechanism for production organizations in the industry. Since 1994, the PRC government has been gradually lifting controls over production quotas and product prices in the industry, permitting an increasing number of petrochemical products to

produce and price according to market mechanisms. The central planned system has been, to large extent, replaced by a market-oriented and entrepreneurial mode of business operation within the industry. The introduction of the free market mechanism, as reported by case companies, has resulted in heightened market competition in the industry among domestic producers over the past five years. However, the majority of managers interviewed considered intensified market competition as a much needed impetus and opportunity for the further development of high-performing enterprises in the industry. The Fifteenth CCP Congress in 1997, decided that the state would "let go" of most under performing SOEs, leaving them to be sold off, merged, or even allowed to go into bankruptcy as market competition and corporate performance dictated. In concert with this the emerging free market mechanism helps point to a cure of the extremely inefficient capital and resource allocation under the centrally planned system, especially in terms of the vast amount of soft subsidizations enjoyed by under-performing SOEs. As a result, the petrochemical industry has become much more concentrated with high performing enterprises over the past five years.

Taken in aggregate, the above macro changes in market demand and domestic industry competition have presented significant impetuses and general opportunities for the further development of high performing SOEs who can supply products in high volumes, cheaply, and to a satisfactory quality.

However, as the case evidence shows, the general pattern of domestic market demands for petrochemical products has also been subject to rapid changes during China's economic and market reform. Market demands have emerged to be dynamic in nature with the increasing development of a free market environment in the past five years. During the ninth five-year plan, as reported by managers interviewed, downstream customers of petrochemical products have been increasingly discerning and demanding about quality. The requirements for high quality has gone far beyond merely conformance quality in a product sense towards an increasing concern for "supply quality" in an organizational sense and perceived "quality standards" of manufacturers, especially in accordance with international standard.

Historically the centrally planned system effectively detached the production organization from its external operating context, and the priority for business operations has been producing the quantity required for the "state", who will guarantee purchase up to the set quota. Little attention has been paid to assuring product quality and other conformances to the full range of customer requirements downstream. Over time it has resulted in a legacy of limited knowledge and capability concerning quality management and improvement in business operations. Given the above macro changes in the pattern of market demands, such lack of knowledge and capability is now one of the most critical constraints facing the domestic Chinese producers in the industry.

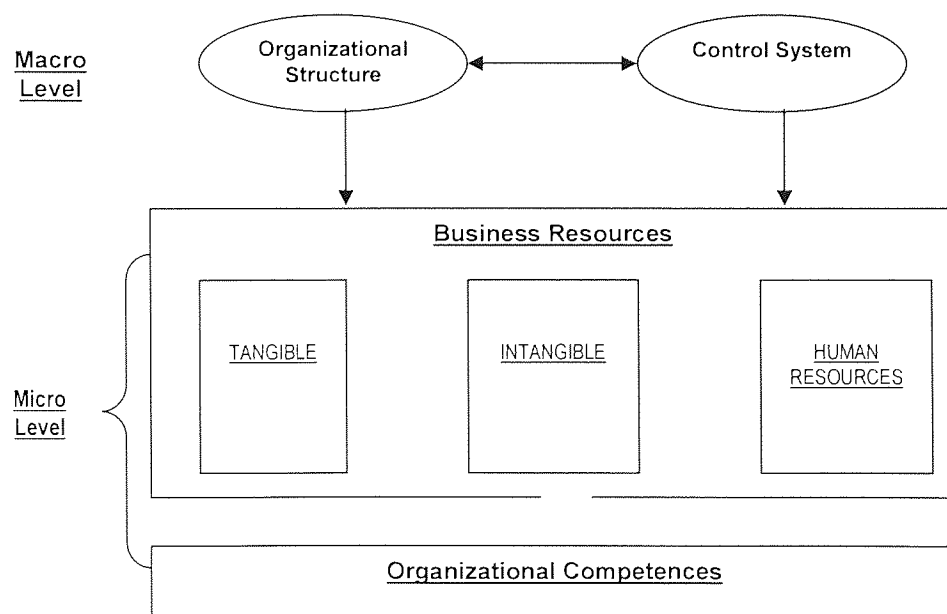
The managers interviewed admitted that products of foreign competitors in the industry have comparative quality factor advantages compared to domestic producers particularly in terms of perceived value in the view of downstream customers. As a result, foreign competitors have obtained a growing share of domestic Chinese markets in the industry over the past five years. In line with its general economic reforms and in order to facilitate its entry to WTO, the PRC government has taken steps to further expose and open its domestic market for petrochemical products to foreign suppliers. Entry barriers of tariffs and quotas, as well as the restrictions on foreign exchange, have been reduced in scope. Lower entry barriers have encouraged more foreign competitors to participate in the domestic market in the past five years. It has also lowered the cost of foreign producers to customers in the domestic market. In turn, foreign products have become more and more affordable and desirable to domestic customers. Entry into the WTO will make China's petrochemical industry more susceptible to competition from foreign participants.

Taken in aggregate, the new trends in the pattern of domestic market demand and industry competition from foreign suppliers have presented a general threat to traditional high volume, mass production in the industry which has little knowledge and capability in quality management and improvement.

➤ Organizational Context

Perceiving and interpreting the organizational context, as revealed from case companies' experiences, have been conducted following the framework presented in figure 7.3 in which organization structure and control system reflect organizational conditions at macro level and business resources and capabilities reflect organizational conditions at micro level.

Figure 7.3 Analysis of organizational conditions engaged by the firm's business operations



Of special note, this empirical classification is different from the classification derived from the literature review (see chapter 4, section 4.3.2). "Human resources" has been singled out and conceived by case companies as one of the critical elements of business resources. Organizational competence is defined by case companies as the technical and managerial capabilities to effectively acquire, deploy and develop business resources, usually in combination.

At the macro level, case companies have organized their businesses to attend to reform policy. At the micro level, case companies have made considerable use of computerised network-based Management Information Systems (MIS) to collect information and monitor the "real-time" condition of the entire operations system. From a manufacturing perspective, this has been mainly reflected in their production planning and control activities. The MIS system provided up-to-date information concerned with timing and scheduling of activities, facility processing conditions, material and energy conversion rates, work-in-progress, quality yield, production inventory levels, and other production information.

There have been drastic changes, as the case evidence suggested, in the organizational conditions within China's petrochemical industry during the ninth five-year plan (1996-2000). The majority of these changes, as reported by case companies, have been government-driven and made operational mainly through GCS and MES reform programmes initiated since 1997. These changes have been enforced and guided in nature through political means. Over time, they have, to large extent, determined the overall organization structure and control systems in the industry. Although self-evolved incremental changes also shape the organization structure and systems, the firms' management could only effect limited organic developments under the government's enforced framework. Therefore, as many respondents suggested, organization structure and control system were regarded as the major aspect to reflect organizational conditions at the macro level. In the past five years these government-driven macro changes in the organization conditions have significantly impacted the management of business operations in large-scale SOEs and presented many impetuses and constraints for the further development of operations at the micro level, especially regarding business resources and organizational competences. Judging from the data collected, these impetuses and constraints have manifested themselves to different extents among the case companies. However, some impetuses and constraints have been significant at the aggregate level, which will be singled out for detailed discussion here within the context of GCS and MES reform programmes.

In broad terms, China's ongoing programme of SOE reform since the 1980s has provided SOEs progressively greater autonomy from the state in dealing with market demands, while also forcing them to take more responsibility for their own profits and losses of business operations. This transition, from near-total dependence on the state to a much more autonomous and market-

oriented mode of business operation has been targeted towards the eventual "corporatization" of large-scale SOEs.

The GCS reform programme focused on the reorganization of industrial companies to optimise the productive power and output of the scale economies of production. In general, the GCS is intended to create large-scale industrial companies that can be internationally competitive following reorganization of their business resources and assets. In 1998, under GCS reform, the two controlling companies in China's petrochemical industry, CNPC and SINOPEC, were reorganized into two independent, fully integrated group companies. CNPC traditionally was engaged only in upstream work, while SINOPEC focused on downstream activities. Now each could undertake upstream oil exploration and production and downstream refining, petrochemical, and distribution activities. With business assets totalling \$57.2 and \$45.8 billion respectively, CNPC and SINOPEC currently rank among the world's top 500 industrial enterprises. GCS pilot reform at Yanshan has reorganized the enterprise into a parent holding company and a large group of subsidiary companies. During the GCS reorganization, Yanshan has been in the process of "optimizing business assets" - separating component parts in its core line of business from others that may be engaged in completely unrelated lines of business.

MES reform programme has been implemented in SOEs within the industry via three major interrelated elements – restructuring (gaizu), reconstruction (gaizao), and reform (gaige). The programme of restructuring (gaizu) involves the further reorganization of all subsidiary companies within the group into shareholding or limited liability companies, responsible and accountable for their own profits and losses. From the perspective of business operations, many managers in the study argued that this has presented an impetus that enables firms to attract outside investment, to borrow from banks, and to enter into joint ventures with foreign companies in their own right. The case evidence shows that the priority of such shareholding restructuring ("gaizu") has been always given to the reorganization of "core business assets" - those core business subsidiary companies within the group. At Yanshan, the group company's five core petrochemical business divisions were first restructured and formed into a joint stock limited company – Yanhua, and listed on the stock exchanges of Hong Kong and New York. This has been followed by a series of other cases of shareholding system restructuring within the group. To the end of 2000, another 19 of Yanshan's business units have been restructured and formed into joint share holding companies and another three of its subsidiaries have been listed on the Shengzhen stock exchange in succession.

The programme of reconstruction (gaizao) involves further technical modification to the production system. Following this initiative, there has been a new wave of technological advancements and production expansions over the past five years in the industry. The case evidence from Yanhua shows that attention has been put into a series of major technical modification projects in the past five years. Given the high capital outlay for imported technologies and facilities, it was widely agreed by managers interviewed that an impetus has emerged for

further improving technical competences in operating efficiency and cost competitiveness of firms in the industry. However, many interviewees also pointed out that, following this "gaizao" initiative, there has been significant managerial attention attached to the technology-led solution of operational improvements to the detriment, which often overlooked the critical need to improve human-based competences and "know how" in effectively operating and managing installed advanced technologies.

The programme of reform (gaige) refers to the adoption of scientific management mechanisms and practices for the firm's operations. Reducing government and political interference in the management of business operations, in the view of managers interviewed, has been the primary aim of the "gaige" programme. In general, it is intended to introduce modern management mechanisms to SOEs. These are seen in China as important elements of the "Western," or capitalist system, and include such concepts as the overall company being directed by a board of directors that answers to shareholders, features that are believed to have enabled Western companies to fend off government interference more successfully than their Chinese counterparts.

At least structurally, SOEs in the industry that have been reformed under MES now more closely resemble typical Western corporate systems. Each of the SOEs taking part in the "gaige" reform experiments now has a board of directors that is supposed to be chosen by its shareholders, which in turn selects the general manager. There has, as many respondents reported, been more autonomy given to the management at the firm level for operating the business in the industry. With the managerial autonomy of SOEs that has now emerged, an organic control system has developed to assist with the coordination of value activities via cross-functional liaison devices rather than merely through specialization and standardization of work.

However, the state is still the sole or main shareholder for most large-scale SOEs in the industry. This means that, in practice, that most candidates for the board are recommended and appointed by the government, which is indistinguishable from the ruling Chinese Communist Party. It was admitted by many managers interviewed that changes in the management mechanism of SOEs have often been more form than substance over the past five year of the reform programme. The ideal of shareholder control has fallen prey to continued direct government and party interference. The high level of government interference in the appointment of boards of directors and senior managers has thus negated one of the main purposes of the MES programme namely the separation of government and management functions. A similar picture emerges when the case evidence was examined for the distribution of power within the companies. Before the reforms, power mainly resided with the so-called "old three committees," namely, the party, the management, and the official trade union. Under the "gaige" initiative of MES reform, these have been replaced by the "new three committees": the board of directors, the board of supervisors, and the shareholders' congress. Many SOEs in the industry, including the case companies of Yanhua, have appointed the branch party chairperson as chair of the board of directors, so the

same person can give orders wearing either "hat." Similarly, existing senior managers have been transformed into a new "board of directors" by a stroke of the pen, and party and union organizations have also found a place on the board of supervisors, allowing power to remain essentially in the same hands but under different titles. The question of how to break up the old vested interests of government in SOEs within the industry was described by many managers interviewed as a "forbidden area" of reform, since it touches on questions of the Party's role today and what the limits of its power should be.

Taken in aggregate, the case evidence clearly shows that the government and party have been reluctant to give up their power and continue to exercise a high degree of influence over management decisions in the firms' business operations. Decision-making regarding personnel selection has been singled out by the case companies as particularly constrained area. These constraints will be reflected and discussed in details from a manufacturing perspective in the later section (see section 7.3.4).

To recap, this section conceptualised the contemporary macro operating context of SOEs in China's petrochemical industry. Through the cross-case data analysis on environmental forces and organizational conditions, impetuses and constraints in the operating context that are significant at aggregate level for the management and development of SOE's business operations have been identified and examined. However, the management of business operations demands a higher level of capabilities in dealing with the impetuses and constraints so as to ensure further development. Over time there has been an emerging difference in the competitiveness and performance of different domestic producers despite the government's interference through policy measures to maintain the synchronization of development among large-scale SOEs in the industry.

7. 2. 2. Conceptualising the Strategic Perspective of Business Operations

The case evidence strongly supports the view that Chinese managers' perspectives on the central concern of business operations have really undergone a sea-change over the past five years, especially following MES reform. Historically, the centrally planned system effectively detached the production system and organization from its external operating context. Thus the central concern of operations management was to reactively seek internal consistency and operational improvements. China's ongoing programme of economic and market reform since the 1980s has sought to develop a free market mechanism for production organizations in the industry. The central planning system has been, to a large extent, replaced by a market-oriented and entrepreneurial mode of business operation within the industry. The central concern of contemporary operations management in China has evolved to configure and improve operations competence and operational performance strategically.

First, the purpose of thinking and managing operations strategically, as argued by many respondents, is not just to improve operational performance in an insulated manner. It is to improve it following a 'strategic direction' in relation to the overall operating context so as to gain, sustain, and further strengthen competitiveness of the business as a whole. That means to seek market-focused, customer-oriented, competitiveness-specific operational improvements which, overtime, could enable and contribute to the firm's competitive position in the marketplace by, for example, delivering greater market value to customers or delivering comparable market value at a lower cost, or doing both. Achieved superior improvements and differences in operational performance following such sense, as case companies reported, have been the essential source of firms' competitive advantage because they directly affect the relative 'cost' position and level of 'differentiation' of business operations. Second, in order to achieve long-term competitive advantage and a leadership position, the firm not only needs to establish such differences in operational performance but also needs, more importantly, to preserve and improve them consistently over time by taking a 'strategic perspective' to operations management particularly towards continuous operational improvements. Historically managers of SOEs have had little or no involvement in the development of corporate, business, marketing, and manufacturing strategies. Now there is an increased recognition that strategic management is the essential mediating force between the firm's operations system and its operating context. Through interpretation of cross-case evidence regarding the strategic management practices (strategic means), both content-wise and process-wise, performed at case companies, managers' strategic perspective (strategic mindset) towards operations management, particularly towards operational improvements, has been identified.

Managers' strategic perspective is reflected in three major aspects of strategic management practice: creating strategic insight into the operating context of business, developing competitive strategy, and establishing strategic consensus within the business particularly for operational improvements. Each will now be reviewed in turn.

➤ Strategic insight into the operating context of business

Changes in market demand, industry competition, and organizational conditions, as discussed earlier, have had significant impacts on operations management and present many impetuses and constraints in the firm's development of business competence. A major aspect of the strategic operations management practices at the case companies has been targeted to create managerial understanding on these three aspects and bringing them together into a strategic insight into the operating context in terms of 'direction' for business development and 'what to do to get there'.

In establishing managerial understanding on the macro operating context, the focus has been on monitoring changes that have occurred, interpreting new trends, and identifying the impetuses and constraints derived on the firms' future development of operations. The characteristic approach adopted at the case companies when interpreting environmental forces and organizational conditions has been conceptualised in the previous section. A clear vision on the macro operating context has been established among managers interviewed at the case companies.

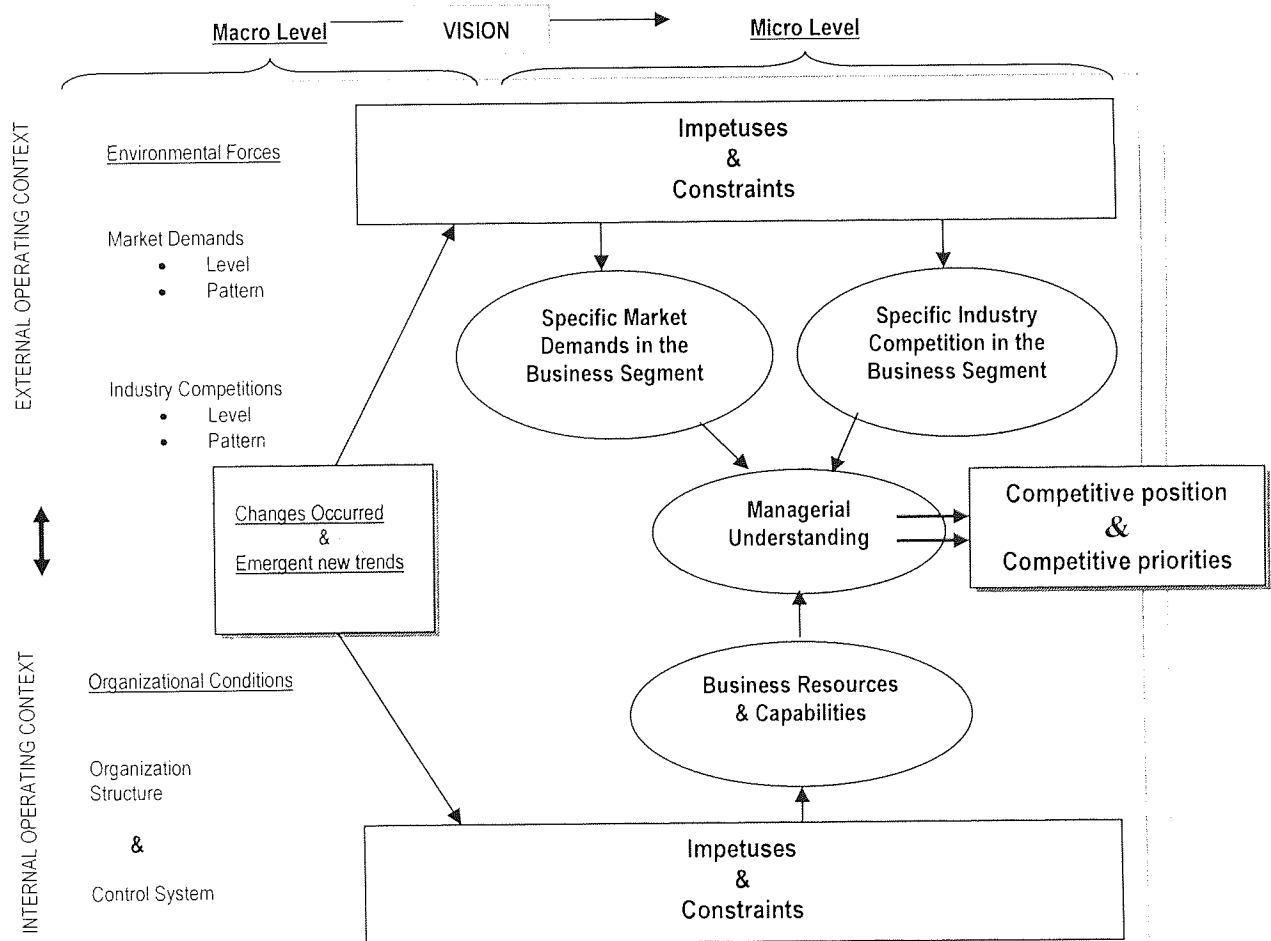
The focus when establishing managerial understanding on the micro operating context has been on specifying market demand, industry competition in the firms' business segment and identifying relative strengths and weaknesses in the firms' business resources and organizational capabilities. Managerial understanding on market demands, as referred to by managers interviewed, is of primary importance here. The case companies usually interpret market demands through identifying "order winners and qualifiers". In so doing, "competitive factors" that are "market-focused" and "customer-oriented" could be identified. Competitors' performance in the segment, then, could be assessed against these identified competitive factors. The competence of firms' business operations could also be assessed against these competitive factors and relative strengths and weaknesses in business resources and organizational capabilities could be identified compared to the competitors. The "value chain" framework and the associated "activity-based theory" of business operations were relevant here. It has widely recognized by management teams in the case companies that the "business" of a firm is defined and made operational through *value activities* performed to create, produce, sell, and deliver its products and services. Value activities are what generate *cost* and create *market value*. According to value chain principles, value activities are *basic units* of the firm's operational performance and competitiveness in the marketplace. The concept of the value chain provides a conceptual framework for managers to think strategically about the value activities involved in their business operations and assess their relative *cost* and role in *differentiation*.

Managerial understanding on the three aspects of the operating context above is then brought together by a "market attractiveness analysis" of strategic management practice through which the *competitive position* that is most beneficial for the business operations in relation to the

overall operating context is identified. The "market attractiveness analysis" performed at the case companies reflects mainly Hax and Majluf's (1989) methodology of assessing the strength of operations in a particular market niche a firm engages according to the long-term attractiveness therein. Further, through "importance-performance" analysis, the *competitive priorities* of business operations can then be identified for operational improvements that are "competitiveness-specific". An "importance-performance analysis" that was performed at the case companies mainly reflected the nature of Slack's (1994) methodology using Importance/Performance Matrices referred in Chapter 3. Identified 'competitive position' and 'competitive priorities' then make up management's strategic insight into the overall operating context which further defines competitive strategy for the business.

The graphical framework shown in Figure 7.4 could summarize the above cross-case analysis regarding strategic management practices at the case companies in developing managerial understanding and creating strategic insight into the operating context of business.

Figure 7.4 Creating Strategic Insight into the Operating Context of Business

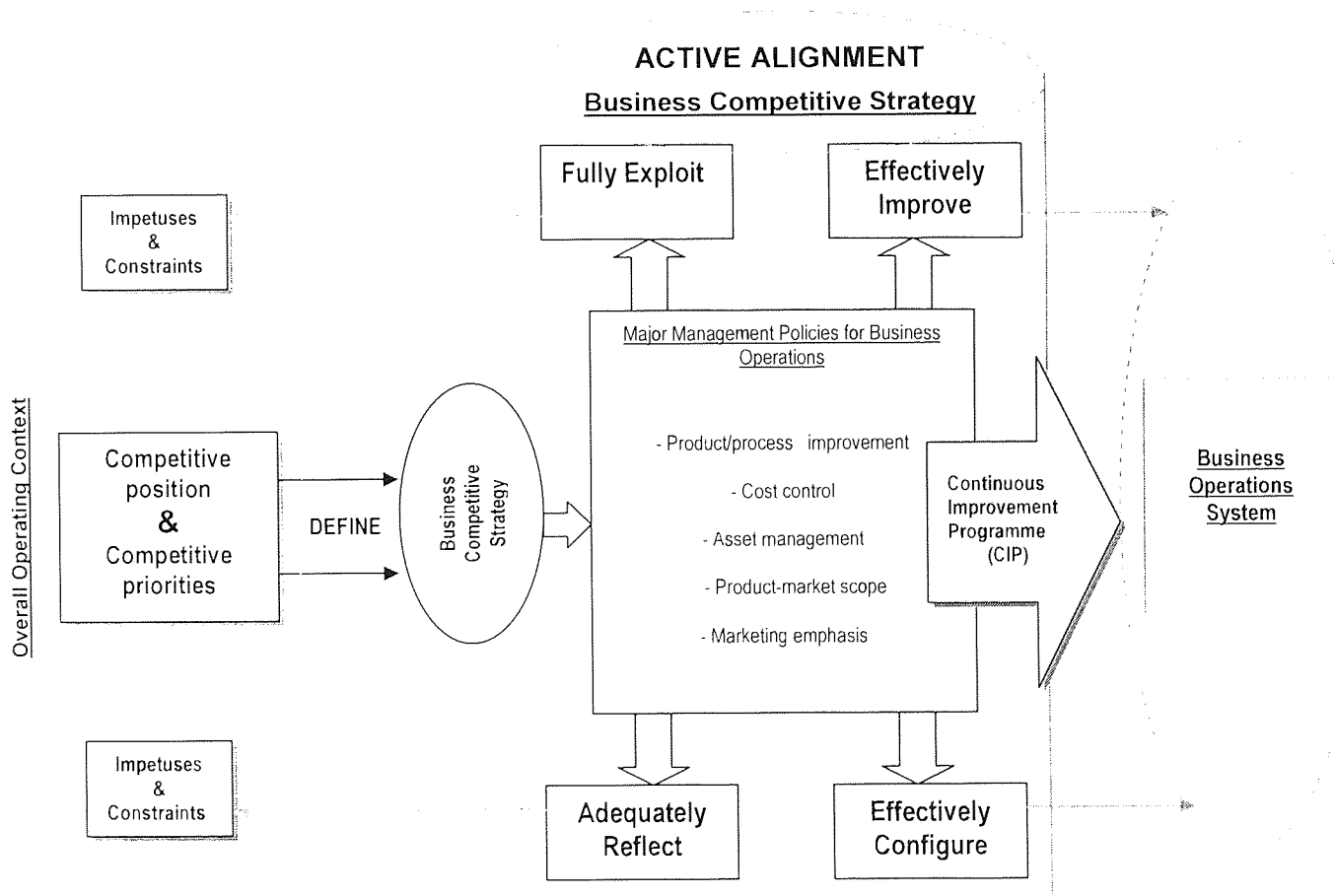


➤ **Business competitive strategy**

Business competitive strategy, as the case evidence shows, has been another major reflection of management's strategic perspective of business operations. Competitive strategy, as the data shows, has translated the above strategic insight into an *active alignment* between the operations system and the operating context over time. That is, on the one hand to translate the 'competitive position' targeted and 'competitive priorities' identified into major management policies such as in product/process improvement, cost control, asset management, product-market scope, marketing emphasis, and performance assessment, to configure and improve operations system accordingly. On the other hand, it configures and improves operations system in such a way so as to reflect particular impetuses and constraints derived from macro changes in the operating context.

The graphical framework shown in Figure 7.5 summarizes the above cross-case analysis on strategic management practices at the case companies when developing competitive strategy.

Figure 7.5: Developing Business Competitive Strategy



➤ **Strategic consensus within business operations system**

Management's strategic perspective, as the case evidence shows, reflects finally by the strategic consensus established within the operations system, especially concerning operational improvements. Such strategic consensus has been demonstrated mainly at two levels.

At the system level, strategic consensus occurs because operational improvements across major functions have all been concentrated on the same 'direction', so contributing to the targeted competitive position with prioritised performance improvements, 'consistent' over time, and 'flexible' to reflect and exploit market, competitive, and organizational changes.

At the functional level, it occurs because, firstly, operational improvements in each major function reflects the competitive priorities identified for business operations and contributes to the targeted competitive position by providing a suitable set of structure, infrastructure, and functional capabilities. Secondly, operational improvements are consistent and reinforce each other across all major functions of the business. Operational improvements at the case companies have gone beyond activity consistency to reinforcing effort. Cross functional information exchange and the coordination of continuous improvements are the most basic types of effort reinforcement revealed from the cases. These over time, eliminated redundancy and minimized waste. These also created pressures and incentives to develop operations competence and improve operational performance with cross-functional in scope. Consistency means that lack of development or poor performance in one function will degrade the improvements in others, so weaknesses are exposed and are more prone to get attention. Conversely, operational improvements in one function will pay dividends in others through effort reinforcement.

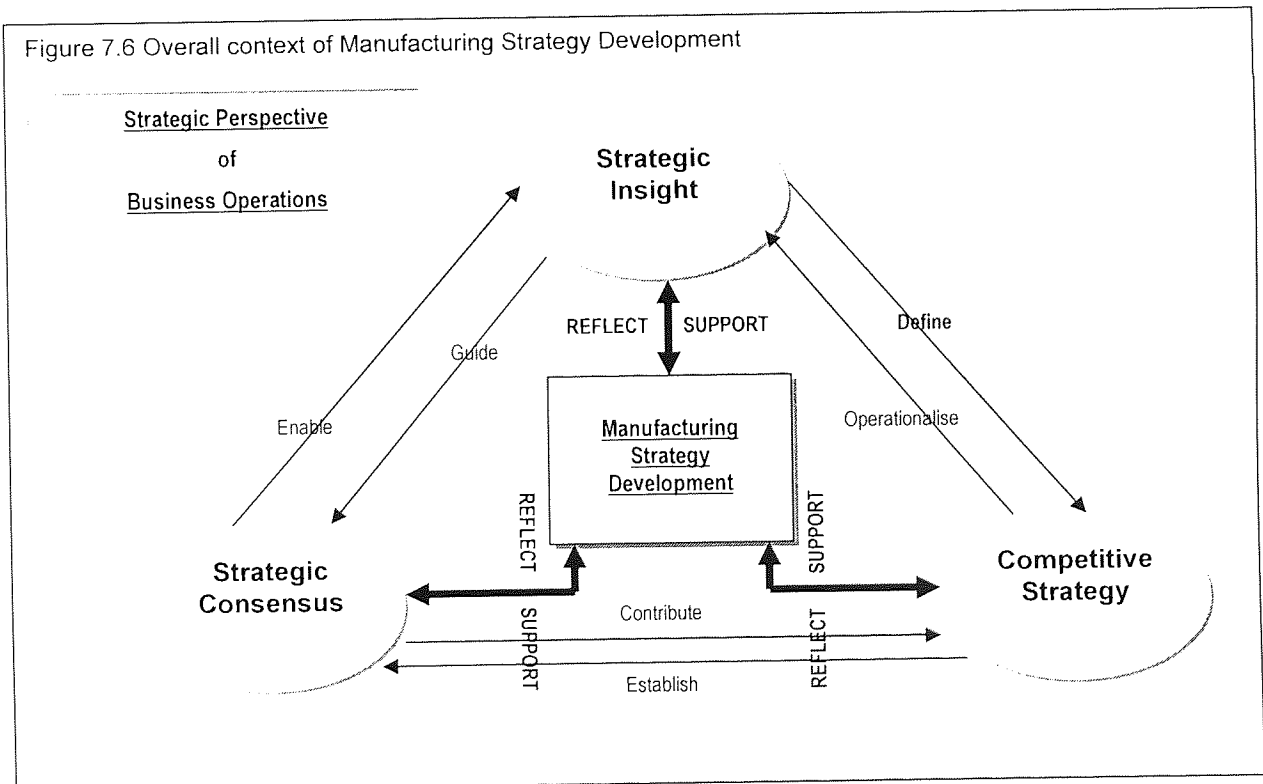
Strategic consensus, when it occurs across functions, also provides the basis for developing strategic insight into the operating context. Managerial understanding and perceptions about the overall operating context actually come about by drawing together analytical information from each major constituent function regarding its principal external and internal operating conditions. This will be further discussed in a later section from the perspective of manufacturing's strategic role (see section 7.3.1).

7. 2. 3. Modelling the Overall Context of Manufacturing Strategy Development

Managers' new strategic perspective of operations management and operational improvements has brought together management's perceptions for the operating context on the one hand and management's perceptions for the central concern of business operations on the other. It has, in fact, integrated management's perceptions on all four contextual aspects defined in the literature into an overall context for the strategic management of manufacturing. Manufacturing strategy development, in the view of many managers interviewed, has to adequately operationalise and fully support such strategic perspective through the way it configures and improves the production system. That means to configure and improve the production system in a way that enables the most beneficial set of improvements in manufacturing structure, infrastructure, and competence.

Based upon the above analysis of strategic insight, business competitive strategy, strategic consensus, and the way in which they interact at the case companies, a configuration framework has been devised by the author to bring them together and model the constellations of these mutually related aspects of the strategic perspective of operations management and operational improvement into an integrative context for manufacturing strategy development (see Figure 7.6).

Figure 7.6 Overall context of Manufacturing Strategy Development



7. 2. 4. An Empirical Configuration of the Strategic Perspective for Business Operations at Yanshan

Operations management and operational improvements across case companies at Yanshan have been revealed to follow the strategic perspective of a lean paradigm.

According to the 'product-based' segmentations introduced at the outset of chapter 6, the case companies, like most other large-scale Chinese SOEs in the industry, manufacture and market products principally in three segments: (i) basic organic chemicals (ii) resins and plastics; and (iii) synthetic rubber. In addition, according to the survey data, the current product mix of many large-scale SOEs in the industry essentially reflects general-purpose origins in the above segments, all of which are highly standardised and at full maturity in terms of life cycle.

Rapid growth of demand at the macro level across the industry discussed earlier has manifested itself as a significant impetus for the development in the above three market segments. As a result, domestic consumption of petrochemical products in these three major categories has grown at a compound annual rate of 16.7 per cent between 1996 and 2000 (The PRC Petrochemical Industry Statistical Annual Report, 2001). Overall demand has exceeded domestic production for five consecutive years since 1996. Numerous managers interviewed believed that the domestic demand of petrochemical products in these three segments would keep growing at a rapid rate and continue to outstrip domestic production capacity for the foreseeable future.

Drastic pattern changes in demand at macro level across the industry have also significantly affected the mix of customer demands in these three segments. Although low price, availability and continuity of supply of product are still regarded as the "order-winners" by most of the market, during the ninth five-year plan downstream customers in the above three market segments have emerged to be increasingly discerning and demanding about quality. Requirements for high quality, as the case evidence suggests, has gone far beyond the mere concern of conformance quality in a product sense towards increasing concern for the supply quality in an organizational sense. This has been reflected by increasing customer requirements for improving "order lead time", "delivery speed and reliability", "order schedule and volume flexibility" in accordance with the rapidly widespread industrial practices of JIT supply in the downstream manufacturing. This has also been reflected by increasing customer requirements for improving "performance quality" of the product to satisfy demands for specialized modifications of standard origins in the above categories. Finally, this has been reflected by the increasing customer requirements for perceived quality standards of manufacturers, especially in accordance with established international standards.

In the past five years macro government-driven changes in organization structures and control systems through the GCS and MES reform programmes discussed earlier have presented

significant impetuses and constraints for the developments of case companies' operations at micro level particularly regarding their business resources and organizational capabilities. Following the "gaizu" and "gaizao" initiatives of MES reform, case companies have further improved their competitiveness in established scale economies through a series of production expansion projects during the ninth five-year plan (1996-2000). Case companies were, in most instances, the largest domestic producers for their respective principal products in 2000. Following the "gaizao" initiative, case companies also conducted a series of major technical modification projects through which technically-based competences in operating efficiency, technological advancement and cost management have been further improved. As a result of the above, case companies are currently among the most efficient Chinese producers in terms of material conversion rate, energy utilization, capacity utilization, and technically-based labour productivity (SINOPEC Economic Information, 2001).

Under the government's enforced "gaige" initiative of MES reform, case companies have managed some organic developments to further configure the organization and better control operations within the given autonomy. From such developments over time, a more "organic" control system has contributed significantly to the coordination of value activities in business processes via cross-functional liaison devices, such as task forces and coordination committees. The use of such devices has enabled the companies to carry out a series of long-term cross-functional programmes of continuous improvement of the "organization" and "quality" of manufacturing. During the ninth five-year plan, case companies have achieved international standards in many aspects of supply quality and have established a leading position for high quality supply among domestic producers. Additionally, through such continuous cross-functional improvements, case companies have accumulated competence in "asset parsimony" and "agility" for exploiting market demands. In terms of perceived supply quality, case companies still have comparative weakness compared to foreign participants in the industry. But this situation is fast improving. Given the requirements for JIT supply partnerships from downstream industrial customers, case companies have developed a degree of comparative advantages for exploiting these new demands within China. However, the case evidence also clearly shows that the government and party have been reluctant to give up their power and continue to exercise a high degree of influence over operations management decisions. Decision-making regarding personnel selection has been singled out by case companies as a particularly constrained area due to government and party interference. These constraints will be reflected and discussed in detail from a manufacturing perspective in a later section (see section 7.3.4).

Intensified business competition at the macro level across the industry has also manifested itself significantly in the above three market segments, especially from major foreign participants. As stated earlier, case companies have all achieved and sustained respective leadership among domestic producers in terms of sale revenues, production efficiency, technological achievement, and quality standards. As the case evidence shows, there are comparative cost factor

advantages for domestic producers over foreign competitors including tariffs, cost of transactions, and cost of transportation etc. However, in the long-term, as China's government lowers the entry barriers in terms of tariffs and quotas and access to foreign exchange, more overseas competitors will be encouraged to enter China with its lower operating cost. This presents an emergent and growing threat to domestic producers who have comparative weaknesses in terms of product quality, achieved quality standards, established scale economies, technological achievement, operating efficiency, and above all, human-based competence for continuous performance improvement.

Taken in aggregate, "strategic insight" into the three aspects of the operating context presents 'high volume low cost production' and 'supply quality differentiation' as possibly the most beneficial competitive positions, in which case companies all have certain level of established advantages and strength for continuous further improvements. The "strategic objective" in attaining such competitive positions is to develop and improve long-term supply partnerships with downstream industrial customers which, over time, and establish a viable and sustainable customer base. Strategic insight into the operating context also identifies scale economies, operating efficiency, technological advancements, product quality, product mix, order lead time and delivery performance as important operational priorities where performance improvement is needed to compete with foreign competitors. These have been encapsulated into case companies' defined competitive priorities for business operations, which are the "simultaneous pursuit of cost competitiveness and quality differentiation". However, developing and improving management and workforce "know-how" and competences, as reported by case companies, underpin these prioritised performance improvements and are prerequisite to achieve the desired competitive position.

Managers at case companies developed "competitive strategies" to translate the competitive position targeted and competitive priorities into major management policies for product/process development, cost control, asset management, product-market scope, marketing emphasis, performance measurement systems, to configure and improve the operations system.

Case companies have been working closely with major downstream industrial customers to improve quality of the product via developing specialized modifications of 'standard products' aimed up-market. Over time, to certain extent, case companies have been able to shift gradually from a general-purpose, standardised product mix towards more specialized modifications with higher profit margin and fast growing domestic demands. It has been widely acknowledged by case companies that increasing emphasis on more specialised product-market scope, which carries higher profit margins, will enhance profitability and improve long-term competitiveness.

Given the life-cycle effects on product/process innovation reported by case companies, product development is essentially process-driven in the industry. This is to be discussed in detail later. However, of special note from case companies' experiences, differentiating the "organization and

quality of operations" in an organic way (compared to a government-driven structural way) has not had a negative impact on the efficient operation of the business. In the past five years of the ninth five-year plan, case companies have pursued intensive asset investments in process technology advancements, production process innovation and reengineering, production facility modifications, and production capacity expansions. Business strategy across case companies has devoted much effort to cost control, focusing on reductions in "production cost" (materials, utility, repair and maintenance, labour, and overhead) and "administrative expenses".

In order to effectively assess the progress in operational improvement, case companies have commonly adopted a "multidimensional" system of performance measurement rather than the uni-dimensional cost accounting applied in the industry. "Cost" and "quality" of the operations are measured using the combination of three sets of measures – product orientated measure (unit cost of finished product and quality in terms of conformance, performance, reliability of finished product), production oriented measure (operating cost/efficiency of production facility and quality yield of production facility), and human-based competence measures (workers/managers' operating cost and quality yield of their work).

The marketing emphasis in the companies has been focused on:

First, developing effective, refined systems for distribution. That is developing more direct sales channels to downstream industrial customers, reducing sales through third parties and the related operating expenses. In order to achieve this, case companies have all expanded their direct sales force and national sales network together with the parent company;

Second, boosting brand image through "high quality of supply" and established "JIT supplier status" so as to reflect the emergent requirements of downstream industry practice. In the meantime, they have engaged in advertising which illustrate the technological advancements in the industry.

Third, the pricing strategy is to retain an attractive low price position (average margin: 7 - 9%) compared to major foreign competitions.

"Strategic consensus" is reflected by the configuration of the above set of management policies through which 'consistency' and 'reinforcement' across each major category can be clearly recognised. The configuration as a whole is concerned about improving the cost competitiveness and quality differentiation of business operations.

During implementation, strategic consensus has been orchestrated by two parallel and interrelated approaches to continuous operational improvements at case companies. During the ninth five-year plan, especially since the "gaizao" initiative of MES reform, the managers kept pursuing the technically-based "total productivity" approach; that is to improve the productive power and output of the established large scale operations. The strategic objective of such an

improvement approach is to enable the firm with accumulative technically-based competences to continuously improve operating efficiency, quality yield and performance, labour productivity and the cost competitiveness of business operations. Improving task-oriented workforce competences and technical "know-how", as referred to by case companies, has been of special importance here. Achieved and sustained cost competitiveness in the industry was seen by case companies as vital for long-term competitiveness, especially sustaining cost advantage over foreign competitors. During the ninth five-year plan, especially since the "gaige" initiative of MES reform, the managers have sought to follow the management-led "total quality" approach to continuous operational improvements; that is to improve the "organization" and "quality" of operations process. The strategic objective of this "total quality approach", as referred to by case companies, is to establish a cross-functional mechanism for improving managerial-based competences and "know-how" in performing team-based operations so as to reduce the bureaucratic control involved in the management. The primary task of such cross-functional improvement mechanism is, then, to eliminate non-value adding activities from the operations process and further strengthen the "total quality" of value adding activities by improving management practices.

At the functional level, strategic consensus has been reflected by the fact that operational improvements in each major function are reflecting and contributing to the pursuit of long-term cost competitiveness and quality differentiation. They are consistent and reinforced with cross-functionalism.

7. 3. Conceptualising the Content of Manufacturing Strategy

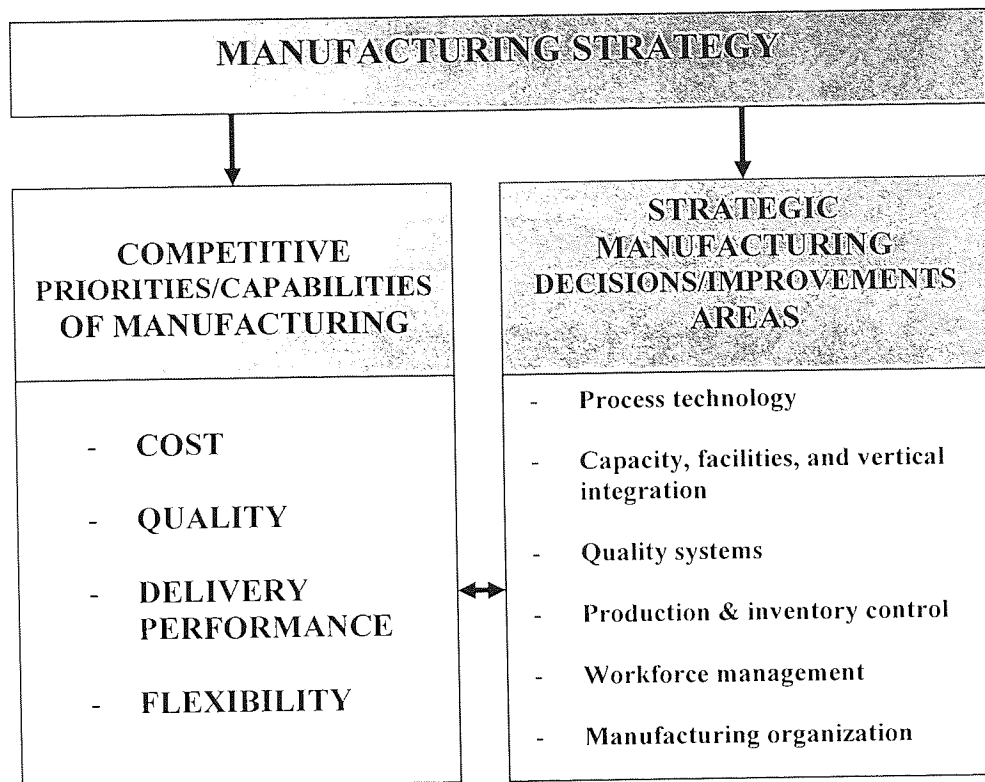
The content of manufacturing strategy refers to the specifics of "what" is decided - a series of decisions made that, over time, enables the firm to achieve a desired manufacturing structure, infrastructure, and set of specific manufacturing capabilities towards long-term competitiveness of the business (Hayes and Wheelwright, 1984). Manufacturing strategy content, as suggested by conceptual models in the literature, embodies both the choice of the most beneficial set of competitive priorities or capabilities in manufacturing for a business unit and strategic decisions on investments and action-programmes to build that set of capabilities (Ward et al., 1996).

A composite view from the literature (e.g. Skinner, 1969, 1978, 1985; Wheelwright, 1978, 1981, 1984; Buffa, 1984; Hayes and Wheelwright, 1984; Fine and Hax, 1985; Hayes, 1985; Van Dierdonck and Miller, 1980; Hayes et al., 1988) yields the following four dimensions of competitive priorities or capabilities in manufacturing – cost, quality, delivery performance, and flexibility. Hayes and Wheelwright (1984) note that the manufacturing strategy of the business unit is reflected and made operational through a series of major decisions consummated in relatively few generic areas – product/production system design, production planning and control, and operational improvement. Different authors have offered lists of strategic decision areas for manufacturing (Skinner, 1974; Buffa, 1984; Hayes and wheelwright, 1984; Fine and Hax, 1985; Hayes et al., 1988). Ward et al (1988) find both empirical support and wide agreement in the literature for a circumscribed set of strategic decision categories in manufacturing which include:

- | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <ul style="list-style-type: none"> • Technology • Capacity • Facilities • Vertical Integration | STRUCTURAL |
| <ul style="list-style-type: none"> • Production and Inventory Control • Quality Systems • Manufacturing Organization • Workforce Management | INFRASTRUCTURAL |

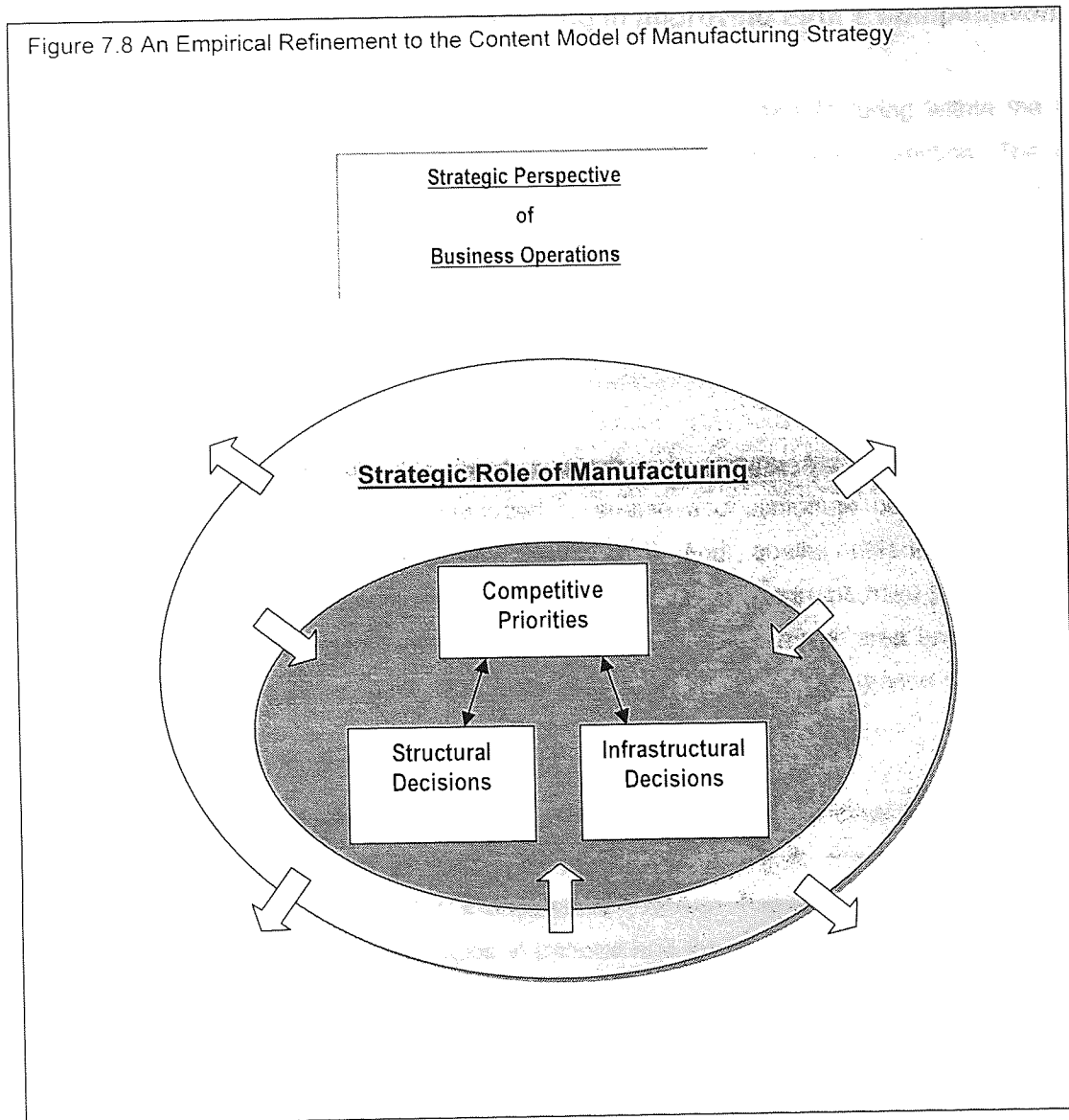
The framework of analysis adopted by the author for investigating and delineating the content of manufacturing strategy has been, therefore, formulated in accordance with the above underlying conceptions revealed in the literature. This has been presented in Chapter 3 (see Figure 7.7).

Figure 7.7 An analytical Framework of Manufacturing Strategy Content (as Figure 3.3)



Following this framework of analysis, the research has investigated in-depth the empirical specifics and managerial perceptions for each content aspect, especially the way in which they interact and function as a whole towards long-term competitiveness of business operations at case companies. The research in the field has been conducted sufficiently openly for the best possible exploration of the locally embedded specifics and relationships of the phenomenon. In so doing, another major aspect of manufacturing strategy content has been revealed at the case companies as the “strategic role of manufacturing” in contributing to the competitiveness of the firm's business operations. It has been widely acknowledged by the case companies that strategic role of manufacturing significantly influences the strategic decisions and improvements consummated within the production system. This indicated an empirical refinement to the above conceptual model of manufacturing strategy content in the literature (see Figure 7.7).

Figure 7.8 An Empirical Refinement to the Content Model of Manufacturing Strategy



Later in the concluding chapter, the theoretical profile of this refined conceptual model has been compared with the one advocated by the existing paradigm. In so doing, theoretical implications of the research findings are discussed in the light of possible developments to the subject knowledge (see Chapter 8 section 8.3.2).

7. 3. 1. The Strategic Role of Manufacturing in Improving Firm's Competitiveness

From the cases one can clearly see the role played by the manufacturing within the overall strategic context of business operations conceptualised in the previous section. The aim of strategic manufacturing management, respondents reported, is to fit the manufacturing competence development into the overall strategic perspective of business operations and create a set of policies, plans and improvement programmes for the production system so as to provide the organization with the most beneficial combination of structure, infrastructure, and competitive capability in manufacturing.

Manufacturing's strategic role has been supportive in nature. Manufacturing's competitive priorities have been decided and managed to enable and contribute best to the pursuit of continuous improvements in cost competitiveness and quality differentiation. In turn, manufacturing's strategic decisions on investments and action-programs have been decided and managed in a way that operational improvements across each major area are consistent and reinforce one other. As a whole they build a set of prioritised performance improvements in manufacturing.

However, as the case evidence shows, manufacturing together with other functions have been also played meaningful roles in participating and contributing to the development of firm's strategic insight and, in turn, the firm's competitive strategy. Therefore, from the case evidence, the strategic role of functional strategies in general and the manufacturing strategy in particular has been supportive in nature and reflected through a configuration of both internal and external contributions.

7. 3. 2. Competitive Priorities of Manufacturing Performance Improvement

The simultaneous pursuit of cost leadership and quality differentiation requires performance across the range of competitive manufacturing (cost, quality, flexibility, and delivery performance) at relatively high levels. However, as reported by case companies, the most essential competitive manufacturing performance is producing at a high level of 'conformance quality' both in product and organizational sense.

In general, the production system must achieve a high level of conformance quality performance before it can pursue low cost or delivery advantages. Low cost manufacturing requires the elimination of wasted time and materials associated with excessive inspection, scrap, and rework attributable to nonconforming value activities or products. Similarly, neither delivery speed nor reliability is possible if delays are caused by failed inspections resulting from continued tolerance of poor conformance. The scope of quality performance improvements, as many respondents reported, has been gradually extended from value activity's own conformance to its performance and over time to its reliability quality. Improved quality performance of value activities, especially cross-functional in scope has further enabled operations to perform more effectively as an organic whole externally. This has reflected in a continuous reduction of order lead-time and actual throughput time at case companies. At the aggregate level, such scope has been termed by case companies as "total quality performance" of production. Although the initial effect for the above quality performance improvement may be to increase unit cost, the managers interviewed argued that there has been a long-run reduction of unit cost. As improved quality is perceived and valued by customers in terms of a higher profit margin, its effects on creating more added value with greater asset parsimony starts to emerge. This has been reflected in a small premium to domestic market prices for many of the case companies' products, a continuous compression of defects, reworks, on site inventory levels, and a greater utilization of production facility and capacity. The pursuit of "cost competitiveness", as the case evidence shows, also requires careful management of scale economies, cumulative experience, technological advancement, and continuous improvements in production efficiency (raw material, energy, facility, capacity, and labour).

Total quality performance and cost competitiveness of the production system, as revealed from the cases, have been built over a long period of time as a part of the continuous operational improvement programmes discussed earlier at the system level. From a manufacturing perspective, the firm's parallel technically-based and managerial-led approaches to continuous operational improvements have been reflected and made operational through a range of improvements and modifications made to the production system over time across a number of key strategic decision areas.

7. 3. 3. Key Strategic Manufacturing Decision and Improvement Areas

There are a common set of strategic manufacturing decisions and improvement areas at case companies that are often most critical for building competitive performance in manufacturing or in other words, that contribute to the 'lean production paradigm' in manufacturing. Because of the capital intensive nature of their business operations, key strategic decision and improvement areas in manufacturing involve both structural decisions concerning improvements in tangible "bricks and mortar" assets and infrastructural decisions concerning improvements in "organization and control" competences which assure effective utilization of those structural investments. These include technological advancements and facility modifications, improvement in production planning and inventory control systems, improvement in quality management systems, and improvement in work organization and workforce competence.

As we shall see, "strategic consensus" has been achieved in the configuration of the above set of strategic manufacturing decisions and improvements through which consistency and reinforcement across each major area could be clearly recognised. The configuration as a whole concentrates on improving the "cost competitiveness" and "quality differentiation" of business operations.

➤ Improvement in work organization and workforce competence

Work organization of production system across case companies is essentially task oriented with well-defined work standardization via formal rules, procedures and established order. Work is also highly specialized as the tasks and responsibilities of different workstations are finely broken down. Such mechanistic work organization has gradually been reengineered through the "gaizao" initiative of MES reform. First, as referred to by interviewees, production processes have been better programmed with refinements in functionally-based work standardization. Second, constituent value activities within the production process have been also honed as the tasks and responsibilities of work are more finely and clearly broken down than before. Following the "gaizao" initiative, case companies have also embarked on a series of technically-based training programmes as part of the overall "total productivity" approach to continuously improve task-oriented workforce skills, technical "know-how", and labour productivity. Performance outcome has been strictly assessed according to established measurements on unit cost and quality yield. As a result, personnel with technical qualifications have increasingly become a key part of the organization. Working in concert with such programmes of workforce improvement and performance assessment, a large technically-based reduction of surplus and incompetent workforce has been conducted across case companies since 1997.

Under the “gaige” initiative of MES reform since 1997, a major modification to the mechanistic work organization of production was made to bring in an organic control mechanism which also enables the coordination of value activities via cross-functional liaison devices, such as task forces and coordination committees. Over time, it has gradually established the outside work design for each workstation within the production system; that is additional duties for each workstation in participating cross-functional improvement groups and quality teams established at shop floor level. The objective of this modification, as reported by case companies, is two fold: first, it is to establish a management-led cross-functional mechanism for continuously improving workforce competences and “know-how” in team-based operations. The focus here is on improving managerial “know-how” and competences in organization and control of the production process as a whole. Second, it is to reduce the bureaucratic control involved in the management of the production system, which otherwise has to be performed by additional coordinators, inspectors, and supervisors. The focus here is on simplifying the management routine involved in running the production system and eliminating non-value adding activities therein. The primary task of this cross-functional improvement mechanism, as many respondents reported, is, then, to continuously improve the “total quality” of production processes as a whole through further strengthening the “quality” of value adding activities therein particularly management practices involved. This also included, as reported by case companies, improvement effort targeted for accumulated team-based (Managerial & Technical) “know-how” and competences in facilities online maintenance and failure recovery with cross-functional in scope.

➤ **Technological advancements and facility modifications**

Most of the processes of case companies are that of continuous process type using flow lines with multiple-stage operations along sequential layouts. Production organizations are process oriented in which plants are dedicated to particular technical processes. Such production organization is best categorized as traditional “mass production”. In the opinion of most in the by case companies, this process choice remains as probably the most appropriate for the high volume production of mature products, where the rate of product innovation, and therefore change and variety, has been relatively low.

Case companies’ production processes and facilities are highly integrated across different product groups. Experiences from the cases show that for the production network to operate effectively, all its stages must work in the chain of synchronized manufacture that has balanced productivity and quality yield targets. From the case evidence, synchronization of productivity and quality yield within the entire network of production appears to be a major concern of managers’ strategic perspective in technological advancement and facility modification during the past five years under the “gaizao” initiative of MES reform.

Therefore, rather than merely concentrating on physical capacity expansion or technology advancement through major technical modification programmes, the human-based “know-how” and competences to operate facilities and technology effectively with cross-functional scope appears to be more critical to the continuous improvement of total productivity and quality yield of production process. Technical and managerial “know-how” have appeared to be both essential and been applied in concert for managing technological advancement and facility modification at case companies. Accumulated technical and managerial competences, often cross-functional in scope, have been revealed to hold the key to enable production system to contribute best to the simultaneous pursuit of ‘cost competitiveness’ and ‘quality differentiation’ of business operations. However, this has to be supported and reinforced by management-led cross-functional mechanisms for improving team-based operations, established through the modification in work organization discussed earlier.

Another major concern was the need to sustain and further improve ‘facility focus’. Facility focus refers to maintaining a relatively narrow set of product/process demands on a production facility. A narrow production focus, as argued by the Western manufacturing literature, is related to good cost performance (Hayes and Wheelwright, 1984; Skinner, 1974; Venkatesan, 1990). Case companies have been faced with manufacturing having to produce a growing variety of differentiated products, with different attributes, different production volumes, and different margins, all of which has been at odds with the notion of facilities focus. Case companies have been regularly reviewing facilities with an eye towards achieving and sustaining sufficient focus, and resolving the largest differences implied by various product lines by modifying multiple sub-plants. A plant-within-a-plant modification to the production facility yields the benefits of focus without sacrificing other scale economies achieved.

➤ **Improvement in production planning and inventory control systems**

During the ninth five-year plan (1996-2000) a major project of continuous improvement in production system across case companies has been the introduction of Materials Requirements Planning (MRP) to assist with the reconciling between production and demand at aggregate level particularly for longer-term production scheduling and raw material purchasing. Major elements included in these MRP systems are the annual demand forecasting and capacity planning and a computer-based production requirements planning and scheduling system.

Annual demands forecasting and capacity planning, as the case evidence shows, have been conducted following a three-step method – forecasting the annual market demands, capacity

booking through annual sales conferences at Yanshan, capacity modifying through annual trading conferences held by SETC and SINOPEC. Based upon the annual demand information of the finished products, case companies then formulated a production schedule using a computerised control and information system to generate material plan, purchase orders, and work orders. The material plan is formulated following a Reorder Cycle Policy which generally specifies purchasing schedule of feedstock and other raw materials of particular types that are needed within an average time intervals of 10-13 weeks. Work schedules are planned at aggregate level based on average setting parameters for production such as, product price, costs of supply, lead time, throughput time, delivery time and inventory holding costs. Deployment of this computerised information and control system has been an important element during the construction of MIS and on top the agenda of technically-based 'total productivity' programme of continuous operational improvements at case companies. The system contains and maintains a production database which is accessible and used by the whole operations network according to their functional requirements. The bill of materials and inventory status is held in the purchase function and updated on an ongoing basis with changes made elsewhere in the operation (e.g. production, engineering, finance, etc.).

Replacing the centrally planned production quota and resources allocation system with such production scheduling and material purchasing systems has significantly improved the management and control of purchasing load and supply network. It has also, as reported by some managers interviewed, enabled purchasing through forward contracts and contributed significantly to the improvement of cost competitiveness through lowering the purchase and order costs of major bought-in materials.

However, as stated earlier, domestic market demands are dynamic in nature. Prices for products fluctuate substantially in concert with international prices. There has also been a fast growing requirement for Just-In-Time delivery from downstream industrial customers. Therefore, there has been huge difficulty in achieving the data accuracy of forecasting demands beyond aggregate level. From case companies' experiences discrepancies between planned production schedule and actual demands of finished products have been, in large extent, inevitable. Where situations change and discrepancies occur, it would result in over-stocking or, conversely, shortages of product supply from time to time.

Given the above, since 1998 a major modification of the production planning and inventory control system has been conducted across case companies to bring in Just-In-Time "pull" mechanisms on a day-to-day basis for the "real-time" control of material flow and production process. A JIT-pull system is inventory-based whereby orders are placed when supply of particular materials or parts is required at the succeeding stage of production. Thus, a triggering effect occurs in which systems pull their requirements from preceding value activities 'just-in-time' to meet immediate requirements. JIT-pull system has started to play a key role in managing the production process in the Chinese case companies, with greater synchronization and asset

parsimony. Reducing the level of production inventories, both work-in-progress and finished products, also allows managers to see quality problems particularly in organizational sense whereby these problems are identified early and the organization then works towards solving them. It thus, as reported by case companies, engenders an improvement approach which fits well with overall management-led "total quality" programme of continuous operational improvements adopted at system level. The successful implementation of JIT, as many respondents reported, requires the basis of an established management-led cross-functional improvement mechanism in performing team-based operations. However, it is also evident, the successful implementation of JIT has further simplified the work organization and management routine involved in production planning and inventory control and eliminated many non-value adding activities within the management practices.

More recently, by further extending the practice of Just-In-Time management from material flow and production control to authorize and manage delivery of products, it has enabled the overall process of business operations to satisfy the emergent trends in demands for improvements in lead times and delivery performance with minimum cost of holding production inventory (work-in-progress/finished products). Therefore, it has also viewed by the manufacturing management at case companies as an effective way of ensuring that production system is responsive and agile in exploiting a free and dynamic market.

➤ **Improvement in quality management systems**

In the past five years, top management across case companies has constantly given the improvement of product quality and customer satisfaction the highest priority within its strategy for business operations. A major modification has been conducted to the quality control mechanism adopted by the production system across case companies. That is to gradually evolve the focus of quality management from the "product quality of conformance" and 'control through inspecting-in' to the "total quality of production" and 'control through designing-in' and 'prevention'. In addition to the established mechanical and statistical programmes of quality inspection and control following the "total productivity" approach, a management-led team-based Total Quality Management (TQM) programme has been gradually implemented at case companies as part of the "total quality" approach to continuous operational improvements.

The benefits of this approach are now becoming apparent. Firstly, the companies conduct routine customer requirements and satisfaction surveys. Improved feedback and contact from downstream customers has led to increased market awareness and knowledge concerning trends in demands. Over time, it has helped the whole production organization to see things from the customers' point of view and increasingly see the importance of "quality" as the key "order-winner" for business operations - and therefore of strategic concern. Identified and specified customer expectations, then, are further interpreted and translated into meaningful requirements

in operational performance for the production system in terms of prioritised manufacturing targets and desirable competences.

Secondly, companies have installed mechanisms of 'internal customer and supplier' in their production systems to promote ownership of quality concern and cover these in the quality programme. The implication of the concept of 'internal customer and supplier', as reported by case companies, was to ensure every workstation within the production system recognized itself in a 'quality chain' whereby errors and quality issues would eventually pass through the internal supply chain and reach the external customers. As the result, all workforce and managers have a substantial understanding about their respective responsibilities to control and improve the quality of particular value activities each performs. However, many managers argued that the establishment of a 'quality culture' within SOEs is indeed a long-term objective of quality management and needs continuous improvements given the historical and social constraints impinged by decades of command economy.

Thirdly, working in concert with the modification of work organization discussed earlier, since 1997 a five-year continuous programme of quality improvement has been conducted across case companies to improve management and workforce "know-how" and competences in performing value activities. The focus here is on improving team-based competence in performing value activities that are cross-functional in scope. There has been a consistent focus within in the programme on exploring and eliminating non-value adding activities in the existing 'design' of production processes and work organizations, and further strengthening the "total quality" of value adding activities performed. Managers also developed a multidimensional performance measurement system to replace the product based cost-accounting measurement in order to more effectively assessing the quality status and quality improvement progress. This involved applying the combination of three sets of quality measurements – product measure (product's conformance, performance, reliability, etc.), production measure (process/facility's conformance, performance, reliability, etc.) and workforce competence measure (workers' conformance, performance, reliability, etc.)

Finally, in order to formally assess the overall quality improvement progress, case companies have been constantly working towards attaining international standard accreditation for their quality management and assurance procedures. This has been seen as a way to measure and improve the established performance, reliability, and effectiveness of management practices and procedures built into the operations system, all of which have a bearing on the total quality of supply to customers. As mentioned earlier, among the drastic changes in the pattern of market demands there have been increasing customer requirements for perceived quality standards of manufacturers, especially in accordance with the international standard accreditation. ISO 9002 deals with quality systems model for quality assurance in production and installation operations. It is been commonly regarded as the benchmark at case companies because it would signify an achieved and sustained standard of "quality management practice" comparable with their

accredited foreign competitors. However, caution has also been widely expressed by managers interviewed at case companies. Such accreditation should only be regarded as a means for assessing and benchmarking quality assurance procedures deployed to improve the total quality of product/service provision rather than a "goal" in itself. The physical certification of an organization to ISO 9002 standards does not necessarily mean that these procedures are followed day-in, day-out.

7. 3. 4. Management Constraints in Further Improving Manufacturing Competence

Macro changes in market demands, industry competitions, and organizational conditions have presented many impetuses and constraints to the further developments of firms' business operations at the micro level. The majority of these macro changes have been essentially government-driven and made operational mainly through government's overall economic, market and SOEs reform programme. These driven changes through political means have been enforced and guided in nature. Over time, they have, to large extent, determined the general market environment, industry competition, and organization structure of SOEs in the industry. Particularly significant to the management of business operations, as many managers at case companies reported, are the constraints imposed by political influence and government interference in an organizational sense, which have important implications for managing operational improvements strategically in the context of SOEs in the industry.

Judging from the interview data collected at case companies, the government and party has been reluctant to give up its power and continued to exercise a high degree of influence over management decisions, especially regarding human resource decisions. This has been reflected from a manufacturing perspective mainly through interview data collected at case companies regarding workforce and managerial staff downsizing during the ninth five-year plan as part of the overall "total productivity" improvement programme.

The approach adopted for such reductions at case companies has been essentially technically-based. This has worked in concert with those established continuous programmes of workforce competence improvement and performance assessment. The key reason for the adoption of this technically-based approach, as shown by interview data, is two fold. Firstly, in truth, workforce reduction has been an often difficult task, especially in China's SOEs, for many social, cultural, and political constraints mentioned earlier at the outset of this chapter. Therefore, it has been essential that the decision should be made on objective, transparent, and fair ground in order to fend off political and social interference. Secondly, downsizing is, after all, only a means to achieve the purpose of total productivity improvement. For it to fully contribute to its purpose, downsizing has to work in concert with established continuous improvement and assessment programmes of workforce competence - to serve as an "imperative" rather than "task". However, political/social interference from the party, as many respondents reported, has undermined these two strategic initiatives of workforce reduction programme. Political interference, often represented by the party branch chairperson at case companies, has always influenced lay off decisions, especially if the employee is a party member. This has, as many managers argued, negative impact on employee's perception for management's initiatives. Particularly in long-term, if this happens to be a continuous pattern towards lay off decisions on incompetent party-member employee, ordinary workers - in fact, the majority of workforce, would start to question the established performance improvement and assessment programmes as the only way to react to

the “imperative” and turning to rather easy “social solutions” for keeping their employment in place. Given the above, as the majority of managers argued, reduction in workforce as a task in itself is rather easy compared to manage it right to serve the strategic initiatives behind it.

However, the most difficult task in downsizing has been reduction of surplus and incompetent managers. The biggest difficulty case companies faced when dealing with surplus and incompetent managers is that most of them are party members and derive their appointments and authority from that status. Regarding this issue the political interference from the party has become obviously stated as regulations of personnel in which lay off decision for managers at functional level has to be approved by party chairperson of the firm and lay off decision for senior managers at SBU level has to be approved by board of supervisors at corporate centre. It has been reported by numerous managers that during the past five years there have been quite few, or if any, managers actually laid off at case companies. Surplus and incompetent managers have been moved sideways rather than down. Doubts were expressed by many respondents regarding how far management's perspective and decision-making quality would change and improve towards “management as a profession” in Chinese SOEs while the “iron armchair” of job security, regardless of competence and performance, was still in existence.

7. 4. Conceptualising the Process Paradigm and Patterns of Manufacturing Strategy Development

In the existing paradigm of manufacturing strategy development, the process of manufacturing strategy has been studied and portrayed as an essentially linear progression through a number of distinct analytical steps. The most prominent contribution is the work of Skinner (1969), who laid the conceptual foundation for a top-down, market deterministic process paradigm and provided the rational planning process pattern for organizing manufacturing strategy development. The Skinnerian paradigm of top-down rational planning to the manufacturing strategy process is very prevalent in the Western literature. However, the popularity of the Skinnerian paradigm in the literature does not prove that it is the universal "best way" - or even a sufficient way - to operationalise the concept of strategic manufacturing management in the contemporary industrial organizations.

Given the critical deficiency of a multidimensional and integrative profile in the existing paradigm from a theoretical perspective identified earlier, the author follows the suggestion from many others (Adam and Swamidass, 1989; Ward et al., 1990; Minor et al., 1994; Amundson, 1998) to integrate concepts, constructs, and essential facets of investigation from the business strategy literature to study the strategy process for manufacturing.

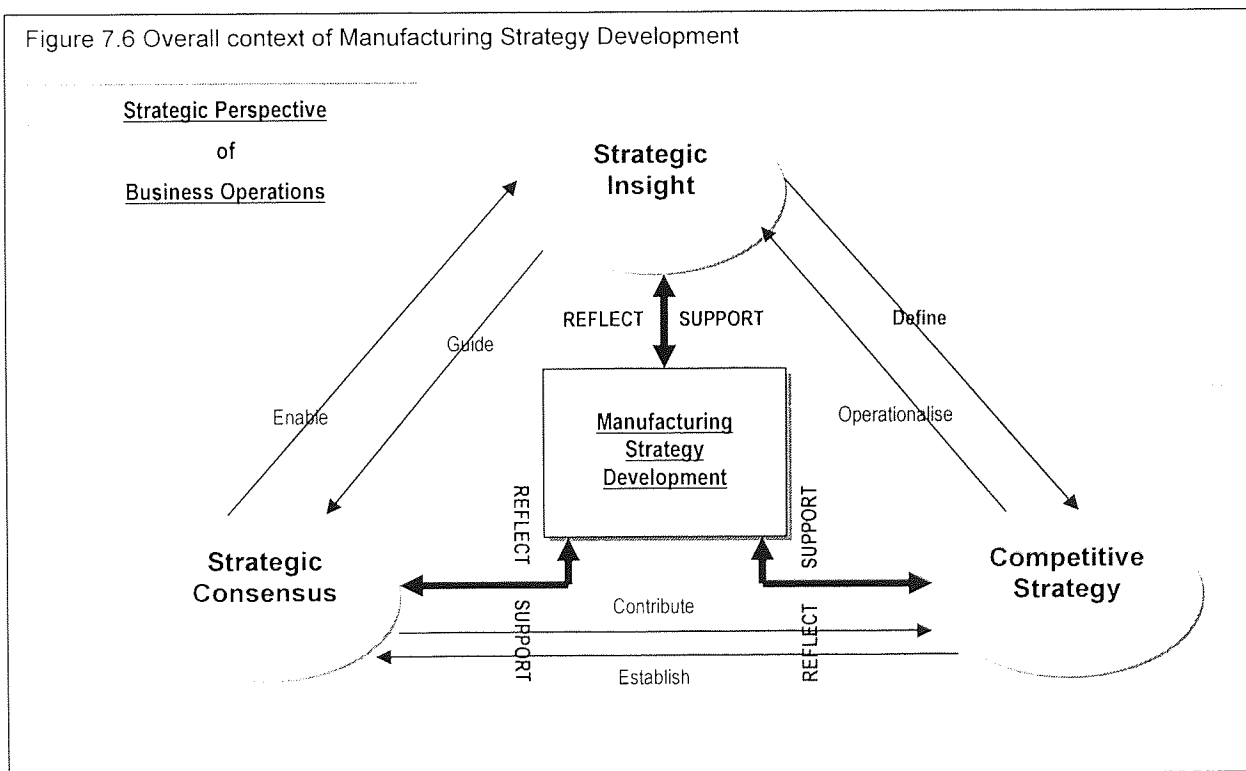
Theoretical perspective of the research is 'integrative school of configuration research on the paradigm of strategy development in the business strategy literature'. From this integrative perspective, Mintzberg (1990) suggests, the process of strategy development is shaped and configured by both deliberate and emergent forces encapsulated within the management paradigm of organizations. However, after Mintzberg (1990), for the effective management of strategy development it is not only the deliberate or emergent process that is our concern, but the actual integrative paradigm by which the deliberate and emergent processes act together under the context embedded and result in a realized and successful strategy. That is precisely exploring, delineating, and explaining the context-embedded and integrative paradigm of strategy development process. Hughes (1997), Bozarth and Mcdermott (1998), St. John et al (2001) and many others have suggested the configuration research as a promising avenue for the future development needed for a context-embedded and integrative profile of manufacturing strategy process. In general, as Miller and Mintzberg (1983) noted, configuration approach to strategy development research yields a systematic, multidimensional, and holistic image of the reality, without attributing causation to any of the individual parts of the whole. The distinguishing characteristic of configuration models, as they state, is the establishment of multidimensional and integrative profiles, which are well suited when investigating the holistic, interdependent, and context-embedded organizational phenomena of strategy development in contemporary organizations.

Followed the theoretical perspective defined above, construction of analytical framework for the empirical investigation has identified six essential facets from the business strategy literature to delineate the strategy development process. These six essential facets have also been defined and applied partly by many previous empirical studies on manufacturing strategy development reviewed in the literature (see Chapter 3). Foregoing discussions on the context and content of manufacturing strategy development have discussed some of these facets to certain extent, especially on the 'organizational involvement' in strategic management process and the 'collection of analytical information' regarding the operating context (external/internal). In this section, research findings derived from cross-case analysis are to be discussed mainly in relation to the other four essential facets of investigation, which have not been covered in much detail previously. However, among them formalization and communication of strategy and managerial leadership within the decision-making process have been singled out by case companies as the most significant aspects in reflecting a changing process paradigm of manufacturing strategy development over the past five years into the MES reform and restructuring. Discussion here, thus, gives primary emphasis on these two aspects. Finally, empirical process paradigm and patterns of manufacturing strategy development revealed from research findings are to be characterized and categorized in relation to the analytical templates formulated as part of framework of analysis that presented in Chapter 4 (see section 4.3.1 for details).

7. 4. 1. Process Specifics of Manufacturing Strategy Development

Foregoing discussions on the management's strategic perspective at case companies towards operations and operational improvement has provided a platform for the discussion here on the process of manufacturing strategy development. In fact, given the theoretical thesis of 'management paradigm' stated at the outset of this thesis, management's strategic perspective conceptualised earlier has a profound influence and provides important implications for the overall strategic management process at case companies (see section 1.2 p.8).

As presented in the configuration framework devised by the author (see Figure 7.6), three aspects represent the key constructs of management's strategic perspective contentwise and the way in which they interact indicates the general process of how management's strategic perspective come about and function over time at case companies. From a process point of view, this has been commonly referred to by case companies as the "developing cycle of management's strategic perspective", which provides a "general framework" for functional strategy development.



A deliberate planning approach is clearly evident therein the "developing cycle of management's strategic perspective". Case companies, as data shows, all have certain form of standardised planning procedures in place derived from the MES restructuring (gaizu) and reforming (gaige) programmes discussed earlier. The development of business strategies and other functional

strategies including manufacturing strategy is now primarily organized at SBU level. The development, reviewing, and modifying of the above strategies, as the case evidence shows, mainly take place at the firm's quarterly strategy reviewing meeting, where operational performance across the system are reviewed and strategic issues are addressed. All case companies have a written mission statement and written strategy for major functional areas since listing on the stock exchange overseas. All case companies, as stated earlier, have adopted systematic approaches as part of their Management Information System (MIS) to collect analytical information from both external and internal operating context of business operations. In the course of interpreting contextual information gathered, case companies have all applied certain analytical tools to aid management decision-making. Performance of operations system and individual work, managers and workers alike, is now strictly assessed according to established "multidimensional" measurements on quality yield and unit cost. In manufacturing, as stated in previous section, this has been made operational through a quarterly based routine performance assessment working in concert with established continuous improvement programmes of management and workforce competence. Reward system at case companies has been also subject to major modifications since the MES reform and restructuring. Currently reward system at case companies have been, to large extent, in relation to work performance at least in financial terms. Performance related promotion and reallocation of managerial staffs at case companies, however, are still subject to continued direct party/government interference. This has been discussed to certain extent from a content perspective in the previous section and is to be further analysed for its strategic implications on competitiveness of business operations in the next chapter.

However, power-behaviour factors and emergent processes in the "developing cycle of management's strategic perspective" are also clearly evident in the research findings derived from interview and observation data collected at case companies. These are to be discussed from the two key aspects that essentially reflect an incremental changing paradigm of functional strategy development process at case companies associated with the MES reform during the past five years.

➤ Managerial Leadership

Managerial leadership, as Westly and Mintzberg (1989) suggested, deals with the extent to which management takes a defined and active role in the process of strategy development. Historically, functional managers at case companies have little or no involvement in the development of business and functional strategies. Strategic issues and planning of business operations were mainly managed at the corporate centre by corporate staffs and top management and with very limited independence and autonomy from State interference. In broad terms, China's ongoing

programme of SOE reform has aimed at giving management of operations progressively greater autonomy at the firm level from the government, especially in the areas of marketing, production and capital investment. Particularly since the MES reform and restructuring at case companies, increasing autonomy has been given to the operations management at the functional level. From a process point of view, increasing autonomy at functional level has been reflected by the changing role of top management and functional executives played in the strategy development process at case companies.

It is first reflected through the role of top-management played in the process of functional strategy development in general and manufacturing strategy development in particular. It is then reflected through the role of functional executives played therein the process and manufacturing executive's role in particular. In order to characterize and categorize respective research findings, the author applied Westly and Mintzberg (1989)'s framework in which they suggest that the role of managerial leadership in strategy development process can be delineated on a generic continuum of spanning presented in Chapter 4 (See 4.3.5 P.56). Tables 7.1 and 7.2 provide a structured overview of the research findings derived from the case evidence (interview data, observation data and documentation) collected at case companies structured by this analytical framework.

Table 7.1 Top Management Role in Manufacturing (Functional) Strategy Development

	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
None - no substantive involvement.				✓	
Facilitator - an involvement whereby the top management takes leadership in facilitating a process in which he or she, along with immediate functional managers, define the strategy.	✓				
Mediator - an involvement whereby the top management collects input from immediate functional managers and then formulates a strategy.		✓			
Formulator - an involvement in which the top management defines the strategy then confers with various functional managers.				✓	
Mandator - an involvement in which the top management defines and mandates strategy, leaving only tactical planning to functional managers.					✓

Table 7.2 Manufacturing Executive Role in Manufacturing Strategy Development

	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
None - no substantive involvement.					✓
Facilitator - an involvement whereby the manufacturing executive takes leadership in facilitating a process in which he or she, along with immediate department managers, define the strategy.				✓	
Mediator - an involvement whereby the manufacturing executive collects input from immediate department managers and then formulates a strategy.		✓			
Formulator - an involvement in which the manufacturing executive defines the strategy then confers with various department managers.	✓				
Mandator - an involvement in which the manufacturing executive defines and mandates strategy, leaving only tactical planning to department managers.		✓			

It is further reflected through the role of functional executive played in the process of business strategy development in general and manufacturing executive's role in particular. To characterize and categorize respective research findings, the author applied Anderson et al. (1991)'s framework in which they suggest that the role of functional executive in the business strategy process can be delineated along a continuum of involvement presented in Chapter 4 (See 4.3.1). Table 7.3 provides a structured overview of the research findings derived from the case evidence (interview data, observation data, documentation data) collected at case companies structured by this analytical framework.

Table 7.3 Manufacturing Executive Role in Development of the Business Strategy

	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
None - no involvement					√
After the fact - manufacturing capabilities are taken into account, yet for all practical purposes the business strategy is developed. The manufacturing executive then develops a tactical plan to support the strategy.					√
Passive - manufacturing is a participant to the extent that manufacturing executive is called upon to express the feasibility of manufacturing being able to support the business strategy.				√	
Active - manufacturing is an active participant which helps define the business strategy by bringing to the strategic planning process the various impetuses and constraints imposed upon the business by manufacturing capabilities.	√				
Leader - manufacturing is leader who shapes, and is actively involved in defining, business strategy.			√		

Of special note, as the study results indicate, manufacturing executive's role has been supportive in nature in the development of business strategy. That is in accordance with relevant research findings on the content of manufacturing strategy discussed earlier (see section 7.3.2).

➤ Formalization and Communication

Formalization and communication, as Hax and Majluf (1988) suggest, deal with the extent to which the strategy is documented, reported, and communicated throughout the organization. It has been regarded by case companies as another major aspect that reflects a paradigm change of strategy development process. It has been widely acknowledged by many managers interviewed that a formalized and well communicated strategy has the benefit of coordinating all strategic initiatives within an organization into a single cohesive direction for the business development. It helps to ensure that strategic consensus could be established throughout the entire organization to avoid overlapping, conflicting, and contradictory

behaviour. This has been strongly supported by research findings on the formalization and communication of strategy at case companies. To characterize and categorize respective research findings, the author applied Hax and Majluf (1988)'s framework in which they suggest that the documentation and communication of strategy can be delineated along a continuum of formalization presented in Chapter 4 (see section 4.3.5 P.58). Table 7.4 provides a structured overview of the research findings at case companies structured by this analytical framework.

Table 7.4 Documentation and Communication of Manufacturing Strategy

	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
No evident manufacturing (functional) strategy					✓
Not written, not well verbalized					✓
Written form, held closely, few know				✓	
Written form, verbally communicated		✓			
Written form, widely disseminated	✓				

7. 4. 2. Process Patterns of Manufacturing Strategy Development

In this section, empirical process patterns of manufacturing strategy development revealed from research findings at case companies are to be characterized and categorized in relation to the analytical templates formulated and presented in Chapter 4 (see section 4.3.1). Upon the study results, an integrative perspective of strategy process patterns is to be derived at end of this section. This would, to certain extent, explain how the deliberate and emergent forces therein the management paradigm act together to shape the strategy development processes and result in a realized and successful strategy of manufacturing at case companies. A graphical framework has been devised to conceptualise the discovered integrative and multidimensional profile of strategy process pattern through which managerial perceptions see the organizational processes involved have been actually organized at case companies.

- **The Planning Dimension**

This dimension generally views that decision-making process involved in strategy development is a distinctly intentional process involving a linear, rational, and planned approach to its organization. The detailed discussion on planning approach to strategy development has been presented in chapter 4 and upon which a characteristic statement has been outlined as analytical template (see section 4.3.1).

Characteristic Statement of Planning Perspective of Strategy Development	
- linear progression of distinct analytical steps	-use of analytical tools to interpret data and determine option
- standardised planning procedures	-dominated role of top management
- planning departments	-low level involvement of functional management
-systematic data collection and analysis	-top-down hierarchical process
-explicit strategy	

As stated earlier, a rational planning approach is clearly evident therein manufacturing strategy development process at case companies. However, not all the above characteristics of planning dimension have found their supporting evidence at case companies.

Major analytical steps advocated by the planning approach do apply themselves therein the manufacturing strategy development process at case companies. However, majority

of managers interviewed suggest that these analytical steps involved in manufacturing strategy development do not unfold following a linear progression as suggested by the planning approach. The empirical development process of manufacturing strategy as managers referred is more complicated at case companies, with analysis, formulation and implementation activities going on all the time, thoroughly intertwined with one another. Functional managers as stated earlier played a role of “formulator” in the development of respective functional strategy at case companies. Top management’s involvement is mainly to facilitating the process rather than to lead or dominate the process. This has been further reflected by the active and meaningful role functional managers played in the process of developing strategic insight into the overall operating context and in turn competitive strategy of operations at case companies. Thus, there has not been a top-down hierarchical process supported by managers interviewed for manufacturing strategy at case companies. Table 7.5 provides a structured overview of the research findings for the planning dimension of manufacturing strategy development. For each of the outlined characteristics, an assessment has been made as to the extent of which management’s perceptions revealed from the interview and observation data support a particular characteristic claim.

Table 7.5 Research findings for the planning dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
linear progression of distinct analytical steps					√
Standardised planning procedures		√			
Planning departments		√			
systematic data collection and analysis	√				
use of analytical tools to interpret data and determine option		√			
dominated role of top management					√
low level involvement of functional managers					√
top-down hierarchical process				√	
explicit strategy		√			

- **The Political Dimension**

This dimension generally views that decision-making process involved in strategy development is also a political process between organizational interest groups each attempting to achieve their own ends. The detailed discussion on political approach to strategy development has been presented in Chapter 4 and upon which a characteristic statement has been outlined as analytical template (see section 4.3.1).

Characteristic Statement of Political Perspective of Strategy Development
<ul style="list-style-type: none"> - Organizations are social networks rather than hierarchies - Different interest group exist in the organization - External interest groups also have strong influence over strategy - Debate and discussion are used to generate solutions - Strategy became acceptable through mutual adjustment - Managers draw on formal analysis is just complementary

Political processes of bargaining, negotiation and compromise between organizational interest groups have been also clearly evident therein the process of manufacturing strategy development through observation at case companies. These interest groups, each of which has different concern, sometime may be in conflict; there may be difference across major functions, groups of managers, between managers and employees, between the firm and its shareholders, government agencies. However, at case companies a predominant difference has been revealed between the political interest and operations concern of the organization. This difference has been resolved through processes of bargaining, negotiation with the result that goals and objectives, strategic issues and even strategy itself are sometimes derived from this political process and not merely from an analytical neutral assessment and choice. During the early stage of MES reform and restructuring, as referred to by many managers interviewed, different views between political interest and operation's concern have been fought for, not only on the basis of the extent to which they reflect environmental or competitive pressures, for example; but also because they have implications for the status or influence of different interest groups in the organizations. Through compromise and mutual adjustment a commonly acceptable strategy has been able to come about. This strategy could finally be adopted because it is acceptable to both those interest groups who influence the decision-making processes and those who must operationalise the strategy, and not solely because it fulfils objective criteria.

Table 7.6 provides a structured overview of the research findings for the political dimension of manufacturing strategy development. For each of the outlined characteristics, an

assessment has been made as to the extent of which management's perceptions revealed from the interview and observation data support a particular characteristic claim.

Table 7.6 Research findings for the political dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
Organizations are social networks rather than hierarchies		√			
Different interest group exist in the organization		√			
External interest groups also have strong influence over strategy	√				
Debate and discussion are used to generate solutions	√				
Strategy became acceptable through mutual adjustment	√				
Managers draw on formal analysis is just complementary		√			

- **The Incremental Dimension**

The dimension suggests that managing strategy development through linear, rational, and sequential planning mechanisms was unrealistic. It argued that, given the complexity of organizations and the environment in which they operate, managers cannot consider all possible options in terms of all possible futures and evaluate these against preset, unambiguous objectives. This is particularly so in organizational context of case companies in which there are so often to be conflicting views, values and power bases as just discussed in the last section.

Characteristic Statement of Incremental Perspective of Strategy Development	
<ul style="list-style-type: none"> - constant scanning of the environment - on-going adjustment of strategy - small scale trial and error approach - formulation and implementation are interlinked 	<ul style="list-style-type: none"> -lack of analytical information to assist decision making -decision-making is influenced by unexpected events -active role of functional managers

Numerous accounts of managers interviewed suggest functional strategy in general and manufacturing strategy in particular take place by comparing options against each other and considering which would give the best outcome and most possible to implement. Majority of managers interviewed at case companies have a view of where they want the organization to be in years to come but try to move towards this position in an evolutionary way. This mode of strategy development is not seen as the sole responsibility of top management. Functional managers and the organization's 'subsystems' are actively involved. Indeed it is the major functions, each of which is concerned with different strategic issues, which raise the awareness of potential strategic problems. Majority of functional managers at case companies accept the uncertainty of their operating context because they recognized that they cannot do away with this uncertainty by trying to 'know' factually about how the environment will change. Rather they seek to become highly sensitive to environmental signals through constant environmental scanning and by testing and developing strategies in a step-by-step process of experimentation and limited exposure to the business environment.

Through ongoing analysis, assessment and incremental refinement, changes in the environment are matched with changes in procedure. This iterative process ensures the strengths of business operations are retained as experimentation and learning undertaken without excessive risk to the organization. Moreover, this constant readjustment allows the mix of resources and capabilities to be reconfigured and improved in relation to environmental changes. It also broadens the information base available, builds organizational awareness and increases the active search for opportunities and threats not preciously defined. Further, the development of strategy in this way means that the implications of the strategy are continuously being tested out. Majority of managers interviewed at case companies suggest this continual readjustment approach to strategy development makes a lot of sense because the environment is considered to be a continually changing influence on business operations in China.

Table 7.7 provides a structured overview of research findings for the incremental dimension of manufacturing strategy development. For each of the outlined characteristics, an assessment has been made as to the extent of which management's perceptions revealed from the interview data support a particular characteristic claim.

Table 7.7 Research findings for the incremental dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
constant scanning of the environment		√			
on-going adjustment of strategy		√			
small scale trial and error approach		√			
formulation and implementation are interlinked	√				
lack of analytical information to assist decision making				√	
decision-making is influenced by unexpected events			√		
active role of functional managers	√				

- **The Enforced Choice Dimension**

This dimension suggests that contextual impetuses and constraints operate to prescribe strategic decisions and sharply limit the role organizational members played in their selection. Equally the strategies an organization can follow tend to be common to all organization within their industrial sector or market; their ability to make strategic decisions outside these is restricted. The detailed discussion on political approach to strategy development has been presented in chapter 4 and upon which a characteristic statement has been outlined as analytical template (see section 4.3.1).

Characteristic Statement of Enforced Perspective of Strategy Development
-powerful outside agencies impose a strategic choice
-macro operating context and changes strongly influence firm's micro operating context
-management's ability to make strategic decision is restricted by the framework impose by outside agencies

This has been discussed in very much detail in the section on contemporary business operating context of SOEs in the industry (see section 7.2.1). The consensus of managers interviewed has happened to be that macro changes in environmental forces and

organizational conditions in the operating context have been of significant impacts on the management of business operations, especially in a strategic sense. Majority of macro changes (external/internal) occurred, as case companies suggest, have been essentially government-driven and made operational mainly through government's overall economic, market and SOEs reform. These driven changes through political means have been enforced and guided in nature. Over time, they have, to large extent, determined the general market environment, industry competition, and organization structure and system of SOEs in the industry.

While intentional strategic choice may be restricted, strategic change does occur to certain extent at case companies. Although in the past five years self-evolved incremental changes did also shape the organization structure and system to certain extent, as case companies reported, firm's management could do only limited organic developments under the government's enforced framework.

Table 7.8 provides a structured overview of the research findings for the enforced dimension of manufacturing strategy development. For each of the outlined characteristics, an assessment has been made as to the extent of which management's perceptions revealed from interview data support a particular characteristic claim.

Table 7.8 Research findings for the enforced dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
powerful outside agencies impose a strategic choice		√			
macro operating context and changes strongly influence firm's micro operating context and management of operations	√				
Management's ability to make strategic decision is restricted by the framework impose by outside agencies		√			

- **The Command Dimension**

This dimension suggests that the strategic decision-making processes can also be seen and shaped by a command vision, which represents the desired future state of the organization, and which is initially or/and primarily associated with an dominant individual.

Characteristic Statement of Command Perspective of Strategy Development
-strategy making by the dominant leader
-simple and informal process
-decision-making is mainly through leader inspiration and intuition

The above outlined characteristics associated with command dimension, however, have not been supported to any extent, if at all, by management’s perspective at case companies revealed from interview data. Table 7.9 provides a structured overview of the research findings for the command dimension of manufacturing strategy development.

Table 7.9 Research findings for the command dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
strategy making by the dominant leader				√	
simple and informal process					√
decision-making is mainly through leader inspiration and intuition					√

- **The Cultural Dimension**

This dimension suggests that the development of strategy and strategy itself can also be attributed to *cultural factors*. The strategy that organization chooses to pursue will not result solely from a precise planned approach to the environment, but under influence from the attributes, values and perceptions, which are common among the members and stakeholders of the organization. In this perspective, strategy development is the organization’s “natural” reaction to a situation and is mainly established through organizational routines, heavily influenced by the organization’s culture and paradigm. These

routines are employed to fulfil standard strategic tasks, such as monitoring the environment, identifying problems, producing information, and generating solutions. These routines are retained and based within the organization's culture.

Characteristic Statement of Cultural Perspective of Strategy Development

-strategy is the outcome of organizational perceptions and routines expressed in the organization's culture

-strategic decision-making is a process of social interaction, based on the collective beliefs and understanding shared by the members of the organization

-culture influences strategy through providing a framework of reference to the individual of decision-making

-strategy takes the form of management's perspective above all rooted in collective intentions

-culture and especially ideology do not encourage strategic change so much, as best, they tend to promote necessary shifts in position within the organization's overall strategic perspective

Several points in the above statement have been discussed previously to certain extent from the content and context point of view towards strategy development at case companies. Almost all managers interviewed suggest that management cannot be conceived simply in terms of the manipulation of techniques or tools of analysis. Management is also about the application of managerial experience build up over many years and often within the same organization or industry. At case companies these have been encapsulated into collective perceptions and standard operating procedures established in strategy development process over time as "the way they do things around there". The meaning they provide allows a shared interpretation of reality and guides strategy development while social interaction establishes the ground for operation. They provide an interpretation of the organization, its perceived relationship with the environment, the direction for information searches and a screening mechanism for information. They also facilitate decision-making, the diagnosis of issues and the formulation of solutions.

When new situations arise in the operating context, they are interpreted by management based on both what has occurred in previous similar situations and on what the collective perceptions would indicate is appropriate. New situations, as many managers suggested, are not perceived to be unique. The information gained from each new situation is subsequently used to confirm the original frame of reference, if this new information fits the general

characteristics of current collective perception. However, if the information is not in accordance with the original frame of reference, the current collective beliefs may be altered in an appropriate manner, or the information may be treated as extraneous event and ignored. In this way the original frame of reference self rationalises and reinforces through the selection of information used by the management.

Table 7.10 provides a structured overview of the research findings for the cultural dimension of manufacturing strategy development. For each of the outlined characteristics, an assessment has been made as to the extent of which management's perceptions revealed from the interview and observation data support a particular characteristic claim.

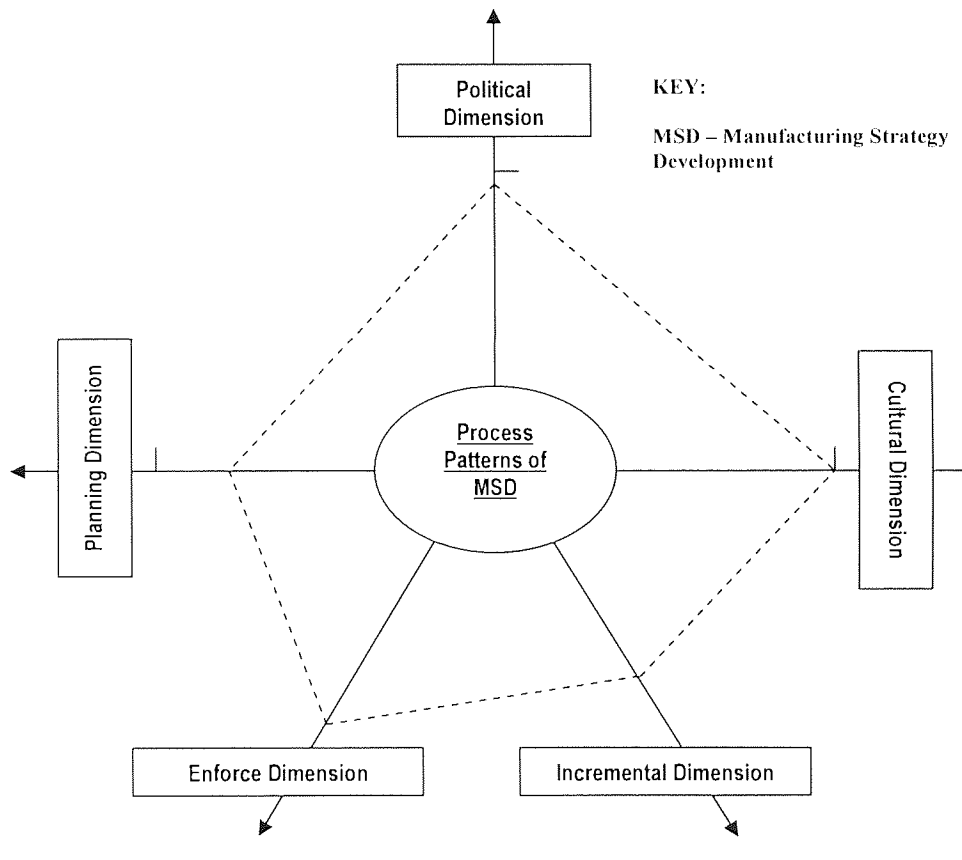
Table 7.10 Research findings for the cultural dimension of manufacturing strategy development

Characteristic Statement	Strongly Agree	Agree	Natural	Disagree	Strongly Disagree
strategy is the outcome of organizational perceptions and routines expressed in the organization's culture		√			
strategic decision-making is a process of social interaction, based on the collective beliefs and understanding shared by the members of the organization		√			
culture influences strategy through providing a framework of reference to the individual of decision-making		√			
strategy takes the form of management's perspective above all rooted in collective intentions	√				
culture and especially ideology do not encourage strategic change so much, as best, they tend to promote necessary shifts in position within the organization's overall strategic perspective		√			

To summarize thus far, it is evident from the above study results derived from cross-case analysis that unlikely any one of these six dimensions in isolation would adequately capture the complexity and actual process patterns of the strategy development occurred at case companies. In fact, with the exception of *command dimension* each of the rest five dimensions can describe or explain some aspects of the process of functional strategy development in general and manufacturing strategy in particular at

case companies. These five dimensions, as study results indicate, are not mutually exclusive and most of managers interviewed at case companies see strategy development process operates through a mix of such dimensions. However, it is clear that political, cultural, and enforced dimensions are particularly significant at case companies. These five dimensions, in fact, formed a multidimensional profile of management's perceptions on the process patterns that actually organized the processes of manufacturing strategy development at case companies. Figure 7.9 provides a graphical framework of this integrative and multidimensional profile revealed from study results.

Figure 7.9 An Integrative and Multidimensional Profile of Manufacturing Strategy Process Patterns



It is important to note that this graphical framework represents how managers at case companies interpret and perceive the actual process pattern of functional strategy development in general and manufacturing strategy in particular.

7. 4. 3. Overall Paradigm of Manufacturing Strategy Process

In this section, empirical paradigm of manufacturing strategy process revealed from research findings at case companies are to be characterized in relation to the analytical templates formulated and presented in Chapter 4 (see section 4.3.1).

In the existing literature, overall paradigm of manufacturing strategy process has been portrayed as essentially top-down and rather overly market deterministic.

Research findings regarding how management at case companies develop “strategic insight” into the overall operating context have indicated a configuration of management paradigm between market-focused, customer-oriented ‘competitive positioning’ and competence-based, human resource focused ‘capability building’.

Managers at case companies take the cues from customers and competitors, and use these signals to determine their competitive position and priorities of business operations. Strategic insight into market demands and industry competitions is regarded by management at case companies as essential. Not only the general structure and pattern of market demands and industry competition needs to be analysed, but also the specifics, strengths, positions and intentions of all major environmental forces the firm engaged need to be determined. Environmental forces are studied at both macro and micro through a distinctly intentional process involving a linear and rational analysis based on application of appropriate analytical and systematic techniques to identify attractive market opportunities and beneficial competitive positions. However, management at case companies also readily acknowledges the importance of firm’s resources and capabilities in determining competitive position of the business operations, especially “human-based competence”. If the firm does not have, or is not able to obtain and further develop, the necessary resources and capabilities underlying a particular strategic insight, then specific market opportunities or competitive positions targeted will be unrealisable or unsustainable. Therefore, management at case companies has been always keeping the comparative strengths and weakness of operations competence in mind when choosing a competitive position to ensure that it remains ‘feasible’ and ‘developable’. In general, therefore, the overall paradigm of strategy process at case companies can be summarized as that of a dynamic configuration between ‘resource and capabilities base’ and ‘competitive position’, or in other words, an active balance between ‘outside-in’ and ‘inside-out’.

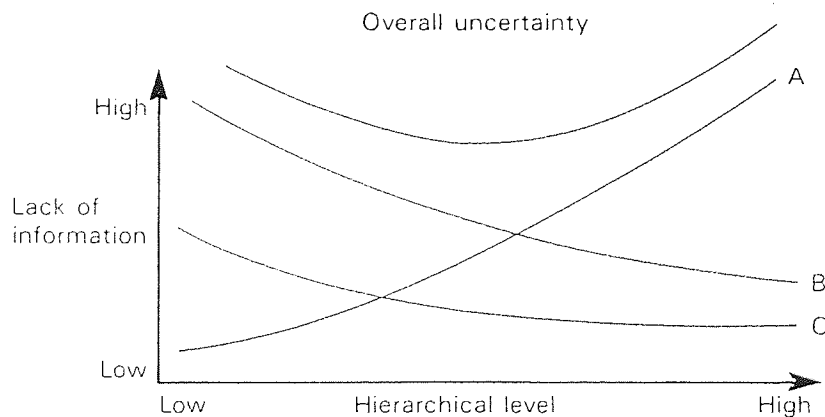
Study results presented in previous section have indicated that top-down hierarchy is not supported by research findings at case companies, neither a bottom-up autonomous decision-making paradigm is evident therein the mechanistic organization structure of case

companies. The “core” of the managerial style within strategy development is not senior managers at top or the autonomous individuals at shop floor, but rather the “functional managers” in the middle. This has been supported by the increasing key role played by functional managers in the strategy development process at case companies.

‘Up’ into the development process of business strategy, functional managers, as research findings indicate, have been actively participating the process, contributing meaningful inputs, and, to large extent, raising the awareness of potential strategic issues facing by the operations. ‘Down’ to the development of specific functional strategy, functional managers at case companies have evolved to play the role of “formulator” facilitated by the top management. The rational behind such emergent distribution of decision-making power within the strategy development process at case companies could be explained with the theoretical framework of Huber and McDaniel (1986) presented in Chapter 4 (see section 4.3.1). According to Huber and McDaniel (1986), decision-making authority should be assigned to the hierarchical level that minimises the combined costs of lack of information about (see Figure 7.10):

1. The problem situation
2. The organization’s overall situation, and
3. The appropriate organizational policy

Figure 7.10: Distribution of Decision-making Power



- A: Cost owing to lack of information about the “situation”.
Usually greater at higher organisational levels.
- B: Cost owing to lack of information about organisational policies.
Usually greater at lower organisational levels.
- C: Cost owing to lack of information about overall organisational situation.
Usually greater at lower organisational levels.
- D: Overall cost owing to lack of information.

Middle management at case companies has been revealed to occupy a key position; it is equipped with the ability to combine strategic macro (context-free) information and hands-on micro (context-specific) information. In other words, middle management is in a position to forge the organizational link between overall strategic perspective and initiatives and specific “know-how” and capabilities building. In general, therefore, the managerial style within strategy process is, in fact, “middle-up and down” at case companies.

7. 5. Conclusion

In the foregoing four sections this chapter has integrated the 'within-case' preliminary data analysis presented in chapter 6 and compared and interpreted the "facts" concerning context, content, and process of manufacturing strategy development explored at case companies via a 'cross-cases' analysis.

The focus of analysis throughout this chapter has been to clarify and conceptualise management perspectives regarding these three dimensions of strategy development practice at case companies when they are operationalising the underlying concept of strategic manufacturing management. As stated at the outset of this thesis, each strategy development phenomena is, by its nature, three-dimensional in nature and only a holistic understanding of all three dimensions will provide the researcher with a real depth of comprehension of the strategist's perspective in managing the phenomena (Pettigrew and Whipp, 1989; Mintzberg, 1997; de Wit and Meyer, 1998). Therefore, the cross-case analysis presented in this chapter has been structured along the 'context', 'content' and 'process' dimensions of strategy development, in which the first dimension has been recognised as the conceptual platform for making sense of the later two aspects according to the defined theoretical thesis of the research.

Research findings derived from the analysis have been presented and thoroughly explained following this structure. Theoretical implications derived from these findings are to be discussed in the next chapter and related back to the original goal and aim of the research project stated at outset of this thesis.

8. Conclusions & Implications of Research Findings

8. 1. Introduction

The detailed research findings of this study were presented in chapter 7. This concluding chapter provides a concise summary of the major research findings and relates back to the original goal and aim of the research project stated at outset of this thesis.

The goal of the research is:

To provide a wider contextual contingency and an integrative perspective for the paradigm of manufacturing strategy development from empirical studies conducted in contemporary industrial companies in China, which could be used for the refinement and future development of context-specific analytical methods and decision aids in operationalising the concept of strategic manufacturing management.

To achieve this goal -

The aim of the research is:

To provide in-depth understanding into the *successful experiences* of managing manufacturing strategy development from SOEs within China's petrochemical industry regarding empirical specifics and managerial perceptions on its embedded context of consideration, its content configuration, and its process organization.

The above general aim was further unpacked into three objectives for the research project, as stated at the outset of this thesis. In this chapter, the main research findings are concluded against each of these three research objectives. The extent to which these objectives have been satisfied and achieved will be determined. The implications derived from the findings are also discussed. Within the context given above, the implications and agenda for future research are outlined – these derive from the limitations of the current study and from issues raised during the course of the investigations. Finally, a reflection is given on what the author has done in this research and what lesson has been learned in terms of research approach for studying the subject.

In this concluding chapter, the author has given primary emphasis to the context aspect of manufacturing strategy development because understanding the embedded context is the fundamental basis for grasping the findings on the content and process of manufacturing strategy and assessing these for effectiveness.

8. 2. Conclusions and Implications of Research Findings for the Overall Context of Manufacturing Strategy Development

In the manufacturing strategy literature, the overall context of strategic manufacturing management has been defined by the work of Ward et al., (1996) and Hill (1994). Environmental forces, organization structure and control systems, resources and capabilities, and competitive strategy of business operations are held to be the most critical contextual aspects in considering and determining the manufacturing strategy. Many other researchers have also offered conceptual models that consider the linkages between the development of manufacturing strategy, the operating context of business, and the competitive strategy of business (Miller and Mintzberg, 1983; Kotha and Orne, 1989; Leong et al, 1990; Parthasarthy and Seti, 1992). However, from the existing paradigm of manufacturing strategy development there is only a limited scale and scope of empirical and conceptual understanding on the above contextual aspects, particularly the way in which they interact and function as a whole. From the analytical review conducted by the author, there has been lack of attention in many previous studies to investigate and conceptualise the contemporary empirical specifics and managerial perceptions towards these contextual aspects. The lack of empirical research that is context-embedded has resulted in emerging contextual limitations in the analytical methods and decision aids from the existing paradigm when apply to a wider social, cultural, and political settings of business in the world today.

As stated at the start of this thesis, the effective use and refinement of a strategy development framework, either in its content or in its process, has to be conducted with substantive understating of the 'embedded context' in which it occurs. Understanding the embedded context of strategic manufacturing management in China's SOEs is essential in order that the constraints impinging upon the improvement of manufacturing competence and its market competitiveness might be identified and possibly, removed. Forrester and Hassard (2000, p.413) suggest that before a new management model or the refinement of existing model could be effectively tailored to the local context of SOEs, it is essential to first establish understanding about the specifics of local operating context with respect to the strategic management of business operations in general and manufacturing strategy development in particular.

Therefore, the 'primary objective' of the research project was decided as:

to develop an empirical configuration for conceptualising context-embedded specifics and managerial perceptions on the overall context of manufacturing strategy development in SOEs within China's petrochemical industry.

8. 2. 1. Conclusions of Research Findings for the Overall Context of Manufacturing Strategy development

The primary objective stated above has been achieved and satisfied by arriving at research findings on the strategic perspective of business operations at the case companies. Presented here is a concise summary of the research findings from the cross-case analysis of case evidence in chapter 7:

First, management's perceptions at case companies for the four contextual aspects defined in the framework of analysis have been brought together and integrated by the strategic perspective of business operations. This has been clearly reflected in data analysis where managerial interpretations of the operating context are linked to their central concern of operations management, particularly in a competitive sense.

Second, strategic perspective of business operations management defines the overall context of consideration for strategic management at functional level in general and manufacturing in particular. Manufacturing strategy development, as widely acknowledged by the management, has to adequately operationalise and fully support this strategic perspective through the way it configures and improves the production system.

Third, managers' strategic perspective stated above has been reflected and made operational through three major aspects of strategic management practices performed at the case companies - creating strategic insight into the overall operating context, developing competitive strategy, and establishing strategic consensus within the business operations systems.

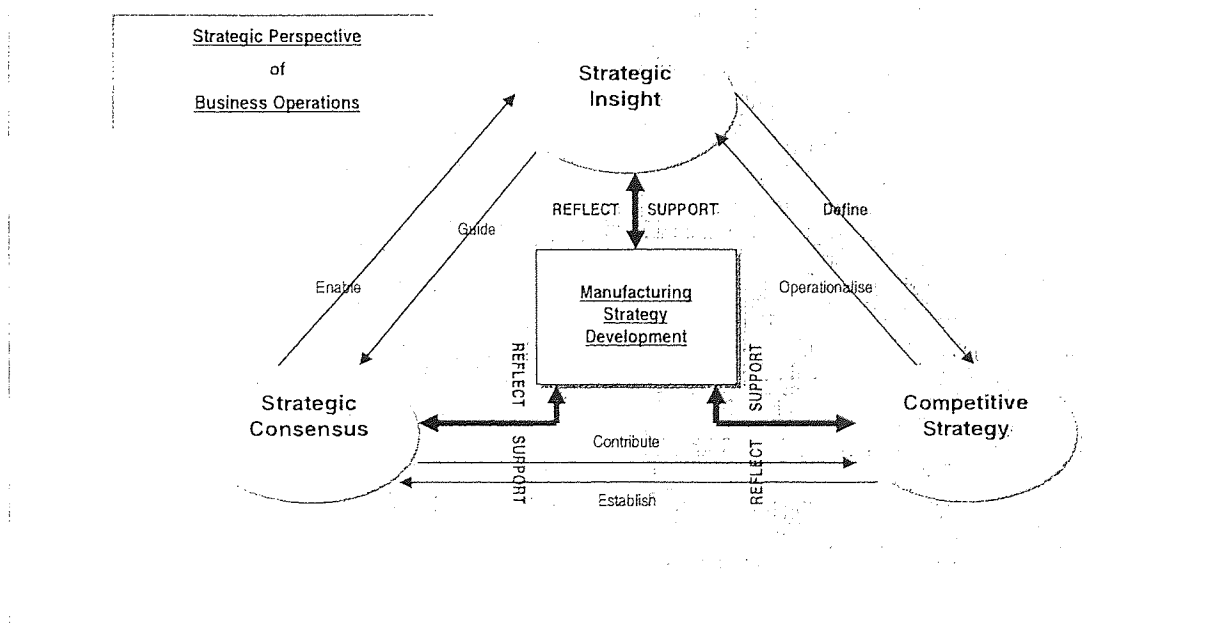
The "operating context" has been defined by both environmental forces (external) and organizational conditions (internal) within which the case companies conduct their business operations. Detailed research findings on how the case companies interpret environmental forces and organizational conditions have been presented in chapter 7. Using this the author devised two analytical frameworks to represent and conceptualise the approaches commonly adopted by managers (see Figure 7.2 and 7.3). "Strategic insight" into the operating context has been developed at both macro and micro levels. In establishing strategic insight into the macro operating context the focus has been on monitoring the changes that occurred, interpreting new emergent trends, and identifying impetuses and constraints on the firms' future development with a long-term vision. A major aspect of the case companies' strategic management practices has been to collect and process analytical information on macro changes in market demands, industry competition, and the government's reform policies. The focus when establishing strategic insight into the micro operating context is on specifying market demand, industry competition in the firms' business segment and identifying relative strengths and weaknesses in the firms' business

resources and organizational capabilities. A major aspect of the case companies' strategic management practices has been concentrated on interpreting analytical information gathered and creating managerial understanding in relation to operations management and operational improvements.

Strategic insight into the overall operating context helps managers to identify the 'competitive position' that is most beneficial for the case companies' operations – a particular market niche, a targeted customer group, a substantial industry competition, etc., in which they have some degree of established advantage and potential for continuous further improvements. 'Competitive priorities' for performance improvements that underlie the above desired competitive position were then further specified (see Figure 7.4). Identified 'competitive position' and derived 'competitive priorities' defined the "competitive strategy" for case companies' business operations. "Competitive strategy" has translated the targeted competitive position and the identified competitive priorities into major management policies to configure and improve the business operations accordingly (see Figure 7.5). The effectiveness of the competitive strategy has been assessed at the case companies mainly through "strategic consensus" established within the operations system, particularly concerning operational improvements. "Strategic consensus" has been demonstrated at both the system and functional levels at the case companies. Strategic consensus, when it occurs across functions, has also provided the basis for developing strategic insight into the operating context (see section 7.2.2).

Based upon research findings on the three aspects above, and particularly the way in which they interact, the author devised a configuration framework to bring them together and model the constellations of these mutually related aspects into an integrative perspective of business operations (see Figure 8.1).

Figure 8.1 Overall context of Manufacturing Strategy Development (as Figure 7.6)



This configuration framework, as confirmed by comments received from those managers who have reviewed an initial research report, provides holistic insights into the contemporary strategic perspective when managing business operations and making operational improvements at case companies. The three aspects define the key constructs content-wise and the way in which they interact defines how the strategic perspective comes about and functions overtime process-wise.

The practical implication is that this configuration framework could be used as an analytical framework to help industrial companies define and assess their strategic perspective of business operations in relation to the firm's operating context. The theoretical implication is that it could be use as a conceptual framework for future research to investigate and conceptualise the empirical strategic perspective of business operations in industrial companies.

The strategic perspective of business operations, as illustrated in cross-case analysis in this thesis, brings together managerial perceptions on each of the four contextual aspects defined in the framework of analysis and integrates them into an overall context of consideration for strategic manufacturing management. Furthermore it does, in the view of managers interviewed, actually define the overall context for manufacturing strategy development in practice at case companies. Therefore, development of this configuration framework satisfies, to large extent, the primary objective of the research project.

Fourth, the strategic perspective of business operations that surfaced at case companies has been configured by a lean paradigm.

Research findings at the case companies provided an "illustration" of managers' strategic perspectives conceptualised by the above configuration framework via an empirical typology developed by the author (see section 7.2.4 for details). In short, strategic management practices regarding business operations across the case companies have been configured by a lean paradigm. This has been well demonstrated by the case companies' ongoing and simultaneous pursuit of multiple competitive priorities. The case companies' performance achievements in "low cost competitiveness" and "high quality differentiation" of their business in general, and manufacturing operations in particular, have also been assessed and seen to be of leadership status among domestic producers. These initiatives qualify the case companies as "lean producer" status, as defined in the Western literature. More importantly, within the empirical typology developed, the author also provided descriptions and explanations of an aggregate implementation approach adopted by the case companies for operationalising the lean paradigm during practice (See section 7.2.4 and 7.3.3 for details).

As to the theoretical implication, this lean paradigm, and its associated implementation approach, is an exciting discovery of the research. Since the publication of the book "The Machine That

Change the World" in 1990, the Womack et al concept of lean production has been the subject of considerable research and debate in the manufacturing strategy literature. Many empirical illustrations have been provided in the Western literature on how lean producers can achieve market competitiveness simultaneously in "cost" and "differentiation" of business operations and effectively supplant mass production in the high volume sector of manufacturing. However, Chinese manufacturing companies in the high volume sector, particularly large-scale state owned manufactures, are reported in the literature of essentially competing on the basis of cost competitiveness, where the emphasis in operational improvements remains largely the enhancement of scale economies, notably the ways and means to increase productivity. Judging from both the critical literature review and the pre-research field investigations, it is clear that there has no published empirical illustration of a lean paradigm in the population of the current study – large-scale SOEs in China's petrochemical industry.

However, managers' perceptions at the case companies have revealed that the unitary pursuit of "high volume low cost" operations is now insufficient for achieving and sustaining market competitiveness in the industry, especially in the longer term. China's government continues to further expose and open its domestic markets, including petrochemicals, to foreign competition in order to facilitate its entry to WTO. As a consequence foreign products have become more and more available, affordable and desirable to domestic customers. In the meantime, certain comparative cost factor advantages currently enjoyed by domestic producers have been, and will be further, diminished. Given the capital-intensive nature of operations in the industry, domestic producers do not have the same intrinsic cost advantage as those in more labour-intensive industries when competing head-on with foreign rivals. Compared to major foreign participants in the industry, and whether on technical- or managerial-based cost competitiveness, domestic producers currently do not have established advantages and accumulated competences, especially human-based competences, for further improvement.

Given the historical context of operations/production management in SOEs under the centrally planned system, the unitary pursuit of "high volume, low cost production" in the emerging free market economy will have embedded limitations for strategic thinking and management within SOEs, especially from a manufacturing perspective. As referred to by several senior managers at the case companies, many other SOEs which have followed a cost leadership strategy in the industry have failed to develop a "strategic perspective" in business operations and failed to actually achieve their goal of cost leadership, especially in manufacturing. A central concern of production management is still to reactively seek internal consistency and operational efficiency at the expense of improving operations' market competitiveness. The emphasis in many firms remains merely to produce as much as possible as cheaply as possible, to the isolation of other factors. Indeed, this goes a long way to explaining the argument made in many previous organizational studies that 'changes are more form than substance in SOEs after many years of management reform'. Modern corporate structures were brought in; production quotas were replaced by commercial contracts. Despite this, however, if managers think about and manage

business operations with the same perspective and mindset (substance) as they used to do, it is just a “new command system” with orders simply coming only in a different form.

The competitive strategy of cost leadership and its underlying pursuit of cost competitiveness in high volume production is certainly a viable paradigm for SOEs in the industry if effectively managed and operationalised. In fact, there have been quite a few successful examples of the implementation of such a paradigm in the industry reported by managers at case companies. Given the fast growing domestic economy of China and, in general terms, the market potential for almost all business segments in the industry, there are huge opportunities for manufacturers who can supply goods in high volume, cheaply and to a satisfactory quality. However, in any specific business segment in the industry, there can only be one ‘cost leader’, and others in the same segment following a “cost leadership” strategy cannot by definition succeed.

Given the above discussion, the author’s argument here is that “cost competitiveness” of business operations in the industry is *necessary* and *essential, especially* in comparison to foreign supplies. However, in order to gain and sustain long-term market competitiveness, particularly when facing the upcoming head-on competition with major foreign rivals after accession to WTO, it is not sufficient. “Differentiation” of business operations in the industry is also necessary - perhaps more so both in terms of ‘long-term market competitiveness’ and ‘furthering SOE management reform’. Although there are different types of differentiation in business operations, research findings at the case companies sketched an achievable strategic configuration of “quality differentiation” with “cost competitiveness” – the lean paradigm in operations management and operational improvements.

8. 2. 2. Implications and Agenda for Future Research

The research findings summarized above have provided an empirically developed contextual contingency for the consideration of manufacturing strategy development in the contemporary business setting of large-scale SOEs in China's petrochemical industry. The findings have been developed from observation of the successful experiences of case companies. The validity of this contextual contingency has been ensured and justified by the context-embedness of empirical investigations during which several tactics, such as 'triangulations', 'overlapping data collection and data analysis', etc., have been deployed for its concern (see chapter 5 for details). As to the theoretical implications, a multidimensional and integrative consideration has been well reflected from research findings at case companies compared to the unitary perceptions advocated in the existing paradigm of manufacturing strategy. This is discussed in detail within the following sections.

➤ Strategic Insight into the Operating Context of Business

Research findings at case companies on successful management practices in developing strategic insight into the operating context have indicated a multidimensional scope of consideration that integrates managerial understanding on market demands, industrial competition, and organizational resources and capabilities of operations. This provides a much needed development from the existing paradigm which advocates a rather overly market deterministic perspective and a resultant unitary marketing-manufacturing interface. The research findings indicate that human-based competence in particular, both in terms of 'technical know-how' and 'managerial know-how', has been widely regarded as one of the most important factors that so often influences and determines how to position business operations and production system with a long-term vision.

Research findings on management practices in developing strategic insight have also indicated a dual emphasis at both macro and micro levels of the operating context. The parameters of macro environmental forces and organizational conditions provided the vision for making sense of the microenvironment within which the firm conducts its business operations. For example, strategic insight into the market demand at the macro level provided a vision for managers to better understand and interpret the level and changing pattern of demands in the firm's particular business segment. This vision is essential, as many managers suggested, for case companies to effectively identify competitive factors that could 'win orders' over time in a rapidly changing marketplace. The strategic insight into the industry competition at the macro level provided a vision for managers to better analyse and assess competitors' behaviour and advantage in the industry in a longer-term. Particularly important, as many managers reported, is the notion of

impetus and constraint derived from these macro changes, especially in an organizational sense, which are often critical for managing operational improvements strategically in the China context.

The majority of macro changes (environmental/organizational) revealed in this study have been essentially government-driven and made operational mainly via the Chinese government's programmes of overall economic, market and SOE reform. Case evidence also clearly shows that the government and party have been reluctant to give up their power and have continued to exercise a high degree of influence over management decisions in business operations, especially concerning human resource related decisions. On questions such as workforce reduction, efficient managerial staff allocation, and the divestment of welfare responsibilities, managers of SOEs in the industry are currently waiting for further action from the central government, without which they can do very little themselves. The consensus of managers interviewed is that SOEs have done as much as they possibly can to transform and improve attitudes, structures, and organization of operations in those areas where they have been given control.

As to the implications for the government reform policy formulation, the next stage in the transformation of China's state-owned petrochemical industry depends, to a greater extent than ever before, on central government decisions in areas such as personnel and welfare reform. As to implications for SOEs in the industry, however, operations managers have to deal with the "reality (impetuses and constraints)" and adequately reflect those "constraints" in their decisions. Therefore, the dualism of 'a clear vision of the reality at the macro level' and 'a sufficient understanding of impetuses and constraints imposed at the micro level', has been shown by the study results to be essential for the further development of manufacturing operations of SOEs in the industry.

Case companies, as the data shows, have all adopted systematic approaches as part of their Management Information System (MIS) to collect and process analytical information on external operating context at both macro and micro level (see section 7.2.1). Case companies have also made considerable use of computerised network-based Management Information Systems (MIS) to collect information and monitor the "real-time" condition of the entire business operations system internally. With the increasing application and importance of MIS, the case companies raised some basic questions during the research as to the strategic implications and use of MIS. A critical need that emerged was for a MIS interfacing model - that is an analytical model to address the link between strategic initiatives and the requirements of MIS in businesses in China in general, and manufacturing in particular. Given the key role played by MIS in creating strategic insight as part of the integrative strategic perspective of operations management it is important to have a structured approach to enable managers to identify the key MIS requirements needed to effectively provide and process analytical information for decision-making.

In their interpretation of analytical information on environmental forces and organizational conditions, the case companies have applied several analytical tools as decision aids to assist with developing managerial understanding and creating overall strategic insight. These analytical tools, as the case evidence shows, includes an “order winner and qualifier framework” for analysing market demand and identifying competitive factors, “value chain framework and activity-based theory” for analysing and assessing operations performance and competitive advantage, “market attractiveness framework” for analysing and determining competitive position, and an “importance-performance framework” for analysing and identifying competitive priorities. The application and refinement for these analytical tools goes beyond the scope of the current study. However, it is an interesting finding that the analytical tools above have been commonly acknowledged, applied and, to certain extent, refined by managers at case companies. Future research is needed to further investigate the application of these analytical tools in manufacturing strategy development, particularly the approach through which they have been configured and tailored to the local context of business operations in China.

Given the significant achievements of case companies in long-term market and manufacturing competitiveness, their emphasis and approach in developing managerial understanding and creating strategic insight to the overall context of the manufacturing operations, therefore, could be justified with further implications for generalisable properties industry wide.

➤ **Developing Competitive Strategy**

Research findings at case companies have indicated six major decision categories in which strategic perspective and initiatives of business operations are reflected - product/process improvement, cost control, asset management, product-market scope, marketing emphasis, and performance assessment. The empirical configuration of the above set of main management policies has been presented in detail in chapter 7, where the lean paradigm of business operations displayed at the case companies was delineated to certain extent (see section 7.2.4 for details). During implementation, the case companies’ lean paradigm has been further reflected and made operational via two parallel and interrelated approaches, commonly adopted to continuous operational improvements – the technically-based “total productivity” approach and management-led “total quality” approach. These have been working in concert and supported by the “multidimensional” performance measurement system developed and applied at case companies for assessing the progress of performance improvements (See section 7.2.4 for details).

Of special note, from case companies’ experiences, the differentiation of the “quality of operations” in such a management-led organic way has not interfered with the efficient and

mechanical operations of the business. This strongly supports a synergies perspective towards competitive priorities in operations. The idea of tradeoffs among the competitive priorities of business operations echoes the well-known work of Porter (1981, 1985), who divided competitive priorities into cost and "differentiation", which included "quality", "dependability", "flexibility", "speed" and "other attributes". However, the research findings here question whether there are necessary tradeoffs between competitive priorities (cost/differentiation) in general, at least in the population of the current study.

In accordance with Womack et al. (1990), and Ferdows and DeMeyer (1990), "underpinning" of the pursuit of multiple competitive priorities (cost/differentiation) has been widely acknowledged are the management and workforce competences and "know-how" developed within the operations system, often cross-functional in scope. Research findings at case companies have further revealed that managerial and technical "know-how" are both essential for achieving lean operations. This is to be discussed in detail from a manufacturing strategy perspective in a later section.

➤ **Establishing strategic consensus**

Establishing strategic consensus within the operations system has been regarded by case companies as a major outcome of strategic management practices. This, however, has not been investigated and conceptualised in depth from the existing paradigm, especially at functional level. Research findings at case companies suggest that it has created pressures and incentives for cross-functional operational improvements. Consistency means that lack of competence development or poor performance in one function will degrade the improvements in others, so that weakness is exposed and prone to get attention. This is regarded by the case companies as particularly important in a longitudinal sense after the 'heat' of reform initiatives burns out. However, on the other hand, operational improvements in one function will pay dividends for others via effort reinforcement.

The establishment of strategic consensus has been contributed significantly through the documentation and communication of competitive strategy in general and manufacturing strategy in particular at case companies. Improved formalisation and communication of strategy over time has enabled a better understanding of the strategic perspective, more informed functional initiatives and consequent improvements, and more orderly involvement of functional inputs in the strategy development process. This will be discussed in detail from a process dimension of manufacturing strategy development in a later section.

8. 3. Conclusions and Implications of Research Findings for Manufacturing Strategy Content

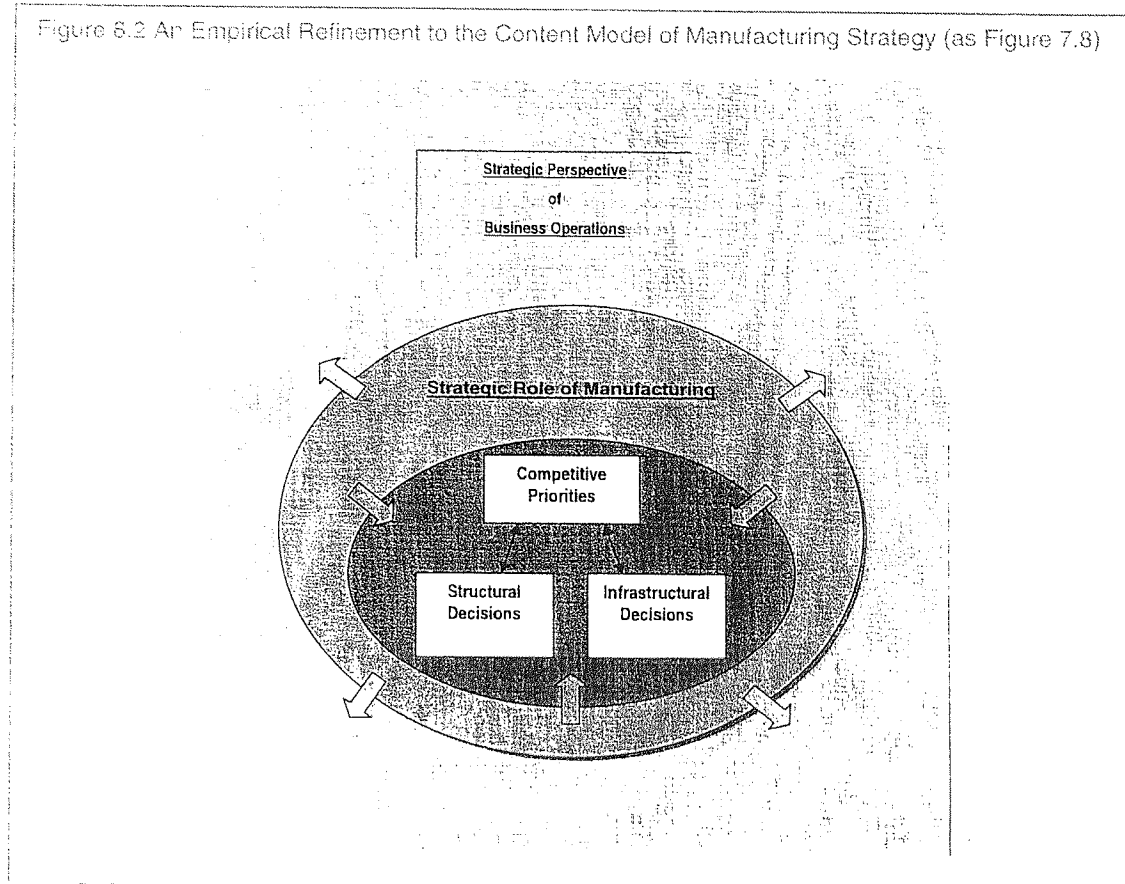
Manufacturing strategy content, as suggested by conceptual frameworks in the literature, embodies both the choice of the most beneficial set of competitive priorities or capabilities in manufacturing for a business unit and strategic decisions on investments and action-programs to build that set of capabilities (Ward et al., 1996). However, as revealed from the critical literature review in this study, the existing paradigm of manufacturing strategy development provides only limited scale and scope for empirical and conceptual understanding of the content aspects defined above. This is especially so for the way in which they interact and function as a whole, contributing to the long-term competitiveness of business operations. Therefore, the secondary objective of the research was:

to develop a content configuration of manufacturing strategy in SOEs within China's petrochemical industry for generating context-embedded understanding regarding the empirical specifics and managerial perceptions on "competitive priority" of manufacturing and related "key strategic manufacturing decisions" in putting together desired manufacturing structure, infrastructure, and set of specific manufacturing capabilities.

8. 3. 1. Conclusions of Research Findings for the Content of Manufacturing Strategy

The secondary objective stated above has been achieved and satisfied by an empirical refinement devised by the author to the content model of manufacturing strategy advocated in the existing paradigm (see Figure 8.2).

Figure 8.2 An Empirical Refinement to the Content Model of Manufacturing Strategy (as Figure 7.8)



Here is a concise summary of the research findings upon which such refinement was derived:

First, the “aim” of manufacturing strategy at the case companies is to fit the manufacturing competence development into the overall strategic perspective of business operations and create a set of policies, plans and improvement programmes for the production system to provide the organization with the most beneficial set of improvements in structure, infrastructure, and competitive performance in manufacturing.

Second, the strategic role of manufacturing has been supportive in nature and reflected through a configuration of both internal and external contributions to the long-term competitiveness of business operations.

Third, the most essential competitive priority of manufacturing at the case companies is quality performance of production. The scope of quality performance improvements at the case companies has been gradually extended from the value activities’ own “conformance” to its “reliability” overtime, and finally to its “serviceability” for associated value activities. At the aggregate level, such scope has been termed by case companies as “total quality” performance of production.

Fourth, improvement in total quality performance has been proven to enable differentiations in other aspects of production performance at case companies, such as volume flexibility and delivery performance. It also has a long-run cost reduction effect through eliminating waste efforts, reducing defects, reworks, and production inventory levels.

Fifth, cost competitiveness and total quality performance of the production system have been built over the past five years through a range of improvements and modifications made to the production system across a number of key strategic decision areas as part of the overall parallel programmes for continuous operational improvements adopted at case companies.

Sixth, there have been a common set of strategic manufacturing decision and improvement areas regarded by the management that are often most critical in contributing to the lean production paradigm in manufacturing. These include manufacturing process type, technological advancements and facility modifications, improvement in production planning and inventory control systems, improvement in quality management systems, and improvement in work organization and workforce competence.

Seventh, constraints derived from political influence and government interference have significant implications for managing operations and operational improvements strategically in SOEs in the industry. These constraints have been mainly reflected through management decision-making on human resources at case companies, which from a manufacturing perspective were well exposed through many organizational issues during workforce reduction programmes since 1997.

8. 3. 2. Implications and Agenda for Future Research

The research findings above have sketched both conceptually and empirically the alignment of production system with the overall context of manufacturing strategy development discussed in previous section. This alignment has been reflected by an empirical “content configuration” of manufacturing strategy (production’s strategic role, its competitive priorities, key strategic decisions). In short, manufacturing strategy content, as the outcome of manufacturing strategy development, has been determined and managed so as to best support (internally/externally) the firm’s strategic insight and its competitive strategy for attaining long-term competitiveness with derived competitive priorities and major strategic decisions for configuring and improving the production system accordingly with strategic consensus.

Within this empirical “content configuration” (see section 7.3.1 – 7.3.3), the competitive priorities and set of key strategic manufacturing decision and improvement areas identified at case companies provides useful insights for implementing a lean production paradigm in the context of China. The most essential element of competitive manufacturing performance, as reported by case companies, is producing with a high level of conformance quality both in a product and a production sense. Improvement in work organization and workforce competence has been singled out by case companies as the most critical requirement for a lean production paradigm, which the existing paradigm of manufacturing strategy development says little about. The key issue of improvement, then, has focused on developing both task-oriented and team-based “know-how” and competences to continuously improve productivity and quality yield of the production process as a whole. Technical and managerial “know-how” and competences have both been regarded by the case companies as essential to enable the production system to best contribute to the simultaneous pursuit of “cost competitiveness” and “quality differentiation”.

In addition, a system-wide integrative perspective towards competence development and performance improvement has been revealed by respondents at case companies as holding the key for achieving a lean production paradigm in manufacturing. This has been well reflected through managers’ desires to achieve synchronization within the production network, maintain production a facility focus, develop a “hybrid” system for production planning and inventory control, extend JIT for supply chain management, and implement TQM initiatives.

The above research findings, together with the strategic role of manufacturing discussed earlier, provide a “blueprint” for transforming traditional mass production of state manufacturing in the industry into lean production with strategic competence for exploring an emerging free market. However, given the focus of the current study, future research is needed to further investigate ‘methodological details’ involved in key modifications and improvements when following such an integrative perspective so as to provide a ‘structured approach’ for implementation.

However, there also exist many constraints derived from the local specifics of market demand, industry competition, and organizational conditions. Particularly significant to operations management, as many managers at case companies reported, are the constraints derived from political influence and government interference in an organizational sense, which have important implications for managing operational improvements strategically in the context of SOEs. Judging from the interview data collected at case companies, this has been mainly reflected through management decision-making regarding human resources and the selection of management personnel, which from a manufacturing perspective, has been exposed through myriad organizational issues during the various workforce reduction programmes since 1997.

Management constraints derived from political influence and government interference have largely undermined the major strategic initiatives of workforce downsizing towards total productivity improvements at case companies. Doubts were also widely expressed by managers interviewed regarding how far management perspectives and decision-making quality would change and improve towards "management as a profession" in Chinese SOEs while the "iron armchair" of job security, regardless of competence and performance, was still in existence.

8. 4. Conclusions and Implications of Research Findings for the Process of Manufacturing Strategy Development

The critical deficiency of a multidimensional and integrative profile in the existing process paradigm of manufacturing strategy development was addressed explicitly at the outset of this thesis from the perspective of a critical literature review conducted by the author. By studying firms using a context-embedded and longitudinal design, researchers of business strategy have provided important insights on how cultural, political and social factors so often influence and sometime determine the process paradigm of strategy development rather than the unitary effect of rational deliberate processes (see Chapter 1 and Chapter 4 for details).

In the chosen population of this research – large-scale SOEs in China's petrochemical industry, this limitation of the existing process paradigm of manufacturing strategy development has emerged to be more critical than has been reported in the Western literature. This has been addressed by previous research findings from Forrester and Hassard (2000), Hassard et al., (1999) and many others – the view that contemporary Western management models and analytical frameworks only provide a partial explanation of strategic manufacturing management practice in China. The Westernised Skinnerian process paradigm and its methodologies of manufacturing strategy development are very limited in the extent to which they are able to explain the complexity of organizational processes involved in the human activity of manufacturing strategy development in the local context of China's SOEs.

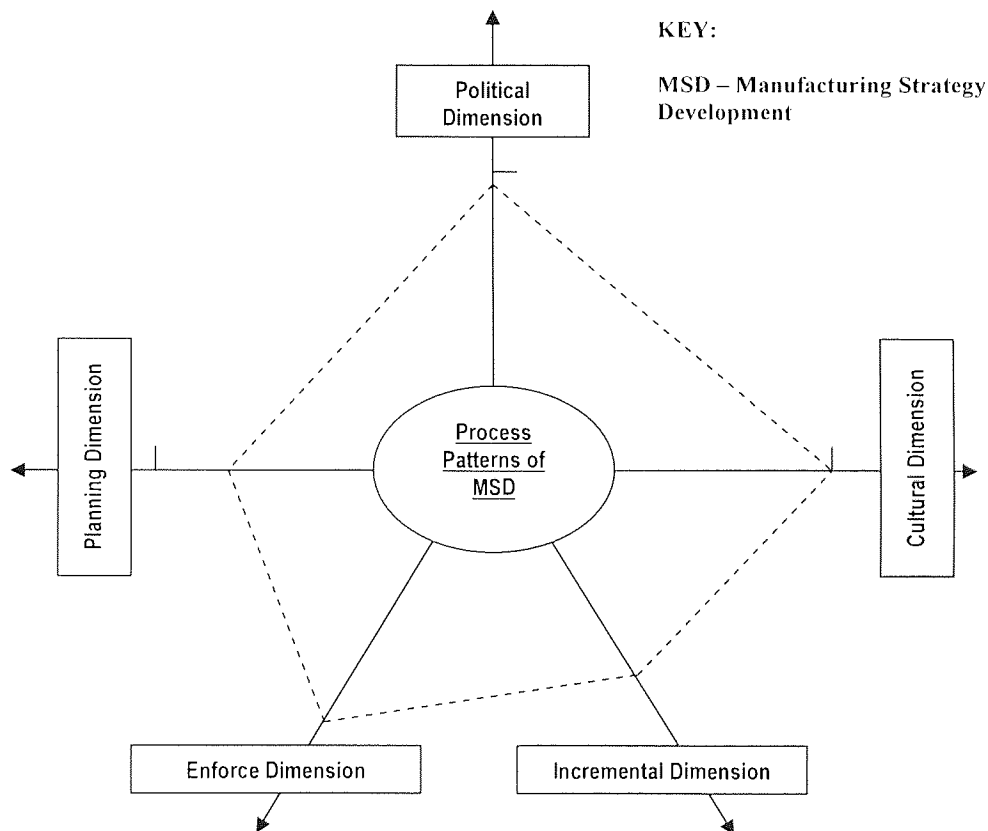
Therefore, the final objective of the research was determined as:

to develop an empirical process configuration for conceptualising the context-embedded specifics and managerial perceptions on process paradigm and patterns of manufacturing strategy development in SOEs within China's petrochemical industry.

8. 4. 1. Conclusions of Research Findings for the Process Paradigm and Patterns of Manufacturing Strategy Development

Research findings on the context and content of manufacturing strategy development discussed earlier have, in fact, provided an essential platform for the research to deliver this final objective. Indeed, research findings regarding this final objective are very tentative and no more than a "sketch" of the empirical process paradigm and patterns of manufacturing strategy development at case companies in relation to the analytical templates formulated in theoretical framework (see Figure 8.3).

Figure 8.3 An Integrative and Multidimensional Profile of Manufacturing Strategy Process Patterns (as Figure 7.9)



However, the exploratory nature of the study has been justified earlier from both the critical literature review and the pre-research field investigations. It is clear that there is insufficient published research on the subject of process paradigm and patterns of manufacturing strategy development in the chosen population of research (see Chapter 3 and 4 for details). Given the exploratory nature and defined focus of the study, research findings related to this final objective are 'satisfactory' at this stage of the study into the subject. There now follows a concise summary of research findings on process paradigm and patterns of manufacturing

strategy development derived from the cross-case analysis of the empirical evidence presented in chapter 7:

First, “managers’ emergent strategic perspective of business operations” provides important implications for the overall strategic management process at case companies, which provides a general framework for the functional strategy development process.

Second, “formalization and communication” of strategy and “managerial leadership” within the decision-making process have been singled out by the case companies as the most significant aspects to reflect a changing paradigm of manufacturing strategy development process over the past five years, through MES reform and restructuring.

Third, process patterns of manufacturing strategy development at the case companies have been conceptualised and configured into an integrative and multidimensional profile that consists of managerial perceptions for the “rational planning” dimension, “political” dimension, the “incremental” dimension, the “cultural” dimension, and the “enforced” dimension.

Fourth, the overall paradigm of manufacturing strategy process at the case companies has been conceptualised as “middle-up and down”, with an active configuration between competitive positioning and competence building.

8. 4. 2. Implications and Agenda for Future Research

The research findings above have indicated that empirical paradigm of manufacturing strategy process at case companies has often been influenced and determined by political, cultural, cognitive, and governmental factors rather than the unitary effect of rational deliberate planning. Among these influential and determining factors, it is the shared beliefs and perceptions of the organization - its paradigm that produces a consensus and homogeneity of options, and facilitates the development of strategy.

The strength of each perspective, and their underlying processes in the explanation of strategy development process at case companies, comes from their combination and not in their sole and isolated use. This is in line with Bailey and Johnson (1993)'s research, which found that different perspectives and their underlying processes of strategy development could occur concurrently within the same organization. It is, therefore, suggested that a clearer understanding of the process of strategy development and its complexity might be facilitated by using these perspectives simultaneously in an integrative and multidimensional profile, as devised by the author. Future research using this integrative and multidimensional profile should permit differences and similarities to be identified in the processes of manufacturing strategy development within the organization, between organizations, and, indeed, across industrial sectors. This will provide wider contextual contingencies for the refinement and future development of analytical methods and decision aids involved in manufacturing strategy development. Finally, and of special note, the increasing key role played by functional managers in the strategic management process of operations has implied future research and reform emphases need to better develop and motivate their managerial competences.

8. 5. Conclusion and Reflection on Research Approach

The aim of this reflection is to review the research approach adopted for the empirical investigation in this study. Rather than engaging a philosophical debate about the merits or otherwise of particular research method, the author approach this matter from essentially pragmatic standpoint, from the perspective of someone considering such research to gain a better understanding and deeper insight into the subject of 'the contemporary management paradigm of developing manufacturing strategy in Chinese SOEs in practice'. Any research method inevitably has both advantages and disadvantages, and as Sliverman (1993, p.2) puts it, "methodologies, like theories, cannot be true or false, only more or less useful". The objective here, therefore, is to draw on the author's experiences in this research project and assist future researchers with making more informed methodological choice in studying the "subject".

➤ Substance and nature of research inquiry VS Methodological Approach

It has been clearly defined, illustrated and justified that this study is a critical and important research inquiry into 'the contemporary management paradigm of developing manufacturing strategy in practice' for both its general theoretical implications and context-specific empirical insights. The overall theoretical thesis is 'contingency theory' namely to investigate manufacturing strategy development practice (its content and its process) in relation to its embedded context, and to analyse the performance implications of the associations between the two. It simply holds that observations are embedded and must be understood within the research context, and that the "best practice" depends on the particular situation and circumstances. The central phenomenon under investigation is the managerial perspectives applied when developing manufacturing strategy in practice namely the internal logic of managerial interpretations towards the content, process and context of strategic manufacturing management. The focus of research inquiry is, thus, on matters pertaining to the 'management mindset and organizational processes' involved and 'patterns of linking mechanisms (deliberate/emergent)' applied. The fundamental research question is 'how the deliberate and emergent management mindset and processes actually integrate and act together to realize a successful strategy in building and improving the production-based competitiveness of the organization. And the interactive, holistic, interdependent, and context-embedded characteristics of the phenomenon are the central issues of the investigation rather than determining prevalence of the phenomenon through number counting and statistical analysis.

From the author's analysis of the manufacturing strategy literature, also as suggested by Minor et al (1994)'s review, the two most widely adopted methodological approach are survey research and case study research. It is extremely doubtful whether the alternative methodological option namely survey research would provide the rich data set required

by this research inquiry. Survey research is here taken to mean the use of large-scale data gathering techniques such as questionnaires administered from a distance, typically by post. This approach, usually involving sophisticated statistical analysis, particularly popular with operations management researchers in America where the overwhelming majority of OM literature is produced. However, survey research risks superficiality (100 metres wide, but one metre deep), and may be unreliable if reliant on a single respondent from an organization. This problem might be particularly acute when studying the subject of this research, as the perceptions and interpretations are actually the inquiry itself and embedded within the cultural, social and political context of the organization. There is a risk that respondents might proffer politically inspired answers based on a desire to protect their own personal interest, that of their workgroup, or that of the organization as a whole. Emphasis of case study research, on the other hand, is on the holistic picture of empirical inquiry, a focused and bounded contemporary phenomenon embedded in its "real life" context. The influences of the context are not stripped away, but are taken into account. It focuses on naturally occurring, ordinary events in natural settings, so that one could have a strong handle on what "real life" of the organization is, what are actually involved in the "real life" process of the organization and of what kind of manners the "real life" process is organized and unfolded. That confidence is buttressed by local embedness, the fact that the data from case study evidence is collected in close proximity to a specific situation. All these make it well suited for studying the subject of this research.

Given the above concern regarding the alternative options, the author believes that a case study research is the most appropriate methodological approach for studying the research inquiry and will make the same choice again if there could be the opportunity to do the project all over again or embark on similar studies on the subject in the future.

➤ Limitations of Methodological Approach adopted

The conclusions and findings arrived at in this study could be often criticised as lacking of external validity as it only involved a small number of cases in a single business setting of manufacturing in the process industry, which is capital intensive in nature with very high fixed investment and long investment life. Although the temptation exists to assume the findings are applicable in many other situations in the context of Chinese SOEs, similar studies should be carried out in other business settings including general batch assembly industry such as in the machine tools manufacturing and job shop industry such as in the construction and installation business where SOEs are also heavily concentrated to help generalize the research findings. However, it is recognised that there is always a certain limitation of time and resources in the disposal of the author or any other researchers

during the doctoral study and it is not feasible to accomplish thorough case study investigations on such attempted scale individually.

- Counter the limitations with holistic and in-depth data set generated

From a theoretical perspective, in order to gain the most comprehensive understanding of the subject the author has given a great deal of attention to the 'synthesis' of the 'three dimensions' of strategy development practice namely its embedded *context* of consideration, its *content* configuration, and its *process* organization. As Pettigrew and Whipp (1989) and Mintzberg (1999) suggested, only by understanding all three dimensions will the researcher gain any real depth of comprehension of the strategist's perspective in operationalising the underlying concepts of strategic management during practice. The distinguishing characteristic of the 'theoretical approach' adopted in this study namely 'configuration models' is also the establishment of comprehensive perspective that yields a systematic, multidimensional, and holistic image of the social reality, without attributing causation to any of the individual parts of the whole. At least according to the author's review of the manufacturing literature (see Chapter 3 sections 3.6-3.7), this study is so far the only piece of reported research on the subject that applied configuration models and incorporated all three dimensions of strategy development practice during the empirical investigation.

From a methodological perspective, the author has surely accessed a wide range and aspect of managerial perspectives within the organization. This has been reflected through investigating the whole set of key players involved in the developing of manufacturing strategy at both corporate and functional levels at case companies and striking a balance between who can offer insights into strategic intentions and those who can reveal the extent to which those intentions have been realised. Of special note is the implementation of semi-structured, open-ended type of interview to enable interviewees to expand on what they actually consider to be important and to frame those issues in their terms. Such interviews allow the author to probe deeply, to solicit expansive responses, and thereby uncover previously hidden details and open up new lines of enquiry.

Together these two major aspects of consideration regarding the research approach, empirical investigation has managed to go "100 metres deep" into the subject and generated a level of holistic and in-depth analysis and understanding of the underlying issues that would not be possible through the use of survey research.

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Appendix A

Covering Letter from Aston Business School for the Research Project



Aston University
Aston Triangle
Birmingham B4 7ET
United Kingdom
Tel +44 (0)121 359 3611
Fax +44 (0)121 359 5271

OPERATIONS & INFORMATION
MANAGEMENT GROUP

To Yanshan Petrochemical Corporation

Date 5 November 1999

RE: Mr XU TIE

Mr Xu Tie is postgraduate doctoral student whom I am supervising at Aston Business School in the UK. His subject area is the application of Operations Strategy to Chinese Manufacturing Organizations. He commenced his studies at Aston in January 1999 and is expected to complete by December 2001.

I would be grateful if you could provide Mr Xu assistance and access to your organization in his fieldwork in China. Please do not hesitate to contact me should you have any further questions.

A handwritten signature in black ink, appearing to read 'P.L. Forrester', written over a horizontal line.

Dr Paul Forrester

Senior Lecturer in Operations Management and
Director of Part-time MBA Programmes

Email: p.l.forrester@aston.ac.uk

Appendix B

Memorandum of Understanding from BIEM for the Research Project

BIEM

International Training Department
Beijing Institute of Economic Management
Add: No.19 Huajiadi Street Chaoyang
District Beijing China 100102
Tel: (86)+10+86441073
Fax: (86)+10+64361276
E-mail: guopei@a-1.net.cn

尊敬的 ASTON 董事会:

99年11月23日贵大学代表徐铁先生来我院寻求两院间的国际合作,与此同时徐先生还带来了贵院的资料和ASTON的介绍。我院愿就两院间合作进行深入的探讨。

我院的基本概况如下:北京市经济管理干部学院是北京市政府批准、国家教育部备案的市属成人高校。主要承担的教学任务有:

- 1、常年为我国512户重点大中型企业(含国有、集体、民营)经营管理人员举办工商管理培训,年培训学员6000左右人次;
- 2、承担国家成人高等教育和普通高等教育,在校生约达1500人;
- 3、我院语言培训中心每年招收900人次学员,其中有学习英、日语的中国学生和学习汉语的300多各国留学生;
- 4、我院函授学院常年在校生约15000人次;
- 5、我院国际合作培训与十几个国家和地区有合作关系,举办过各类管理培训班,均获好评。

我们此次通过贵大学的材料介绍以及与贵方代表徐先生进行了友好交谈,并就有关企业培训、学术交流和相关教育等问题交换双方的见解,进行了初步的探讨。对贵大学提出的有关合作感兴趣。尤其对贵大学在英国本土及在北美、欧洲与工商界有着较好的合作关系表示钦佩和极大的关注。随着中国加入WTO的临近以及全球经济一体化的确立,教育作为产业势必拉动经济的发展,中国企业势必要培训各类人员满足市场需求。对双方发展合作是良好的契机。我方也希望能与贵大学进一步探讨有关培训、教育等领域的合作,并希望贵院高层人士在方便的时候到我院参观考察、磋商有关事宜。

北京市经济管理干部学院

国际培训部
主任魏晶

1999年11月

国际培训部

Appendix C

Letter of Support from Yanshan for the Research Project

中国石化
集团 北京燕山石油化工有限公司

LETTER OF SUPPORT FOR ASTON BUSINESS SCHOOL PROJECT

Beijing Yanshan Petrochemical Corporation (BYPC) express their strong support for the proposed Aston University-based project entitled "*Business and Manufacturing Strategy Formation within a Chinese State Owned Enterprise*". At BYPC we are committed to further developing our manufacturing and business effectiveness and consider this research project as an important element in the evaluation and improvement of strategic decision-making and organizational processes within the corporation. Following detailed discussions at BYPC in March 2000, we wish to deepen our relationship with scholars from Aston Business School whom, we recognise, have a strong track record in management research in China. We would expect outcomes from the project to positively contribute to our strategies for manufacturing and human resources development through exposure to Western management practices and their adjustment to our own needs. BYPC has a good personal relationship with the team at Aston and would welcome the opportunity to extend this relationship on a formal footing into the future.

On condition of the grant application being successful and external funding being provided, we are pleased to grant access to operations and senior managers within BYPC to enable fieldwork investigations for the duration of the project. Our contribution to the project will include our managers' time and the establishment of a research team based within the corporation. We are also prepared to cover the costs of accommodation and food for visitors from Aston for the duration of their stay at BYPC (around 3 person visits for 10 days per year). We are also willing to cover the costs of flights for our own research team members (around 3 people per year) when visiting the UK. In addition we will provide a direct financial contribution of £7000 per year for two years to the research team at Aston Business School as a sign of our commitment to the research.

We look forward to hearing the outcome of the grant application and, if this is successful, to working with research colleagues from Aston University on this important and exciting project.

Yours sincerely



Mr Du Guosheng
Director and President
Beijing Yanshan Petrochemical Company Limited

Appendix D

Qualitative Interviews Conducted During the Field Investigation

Interview 1, 1999, was conducted on May 11, 1999 with the CEO of Beijing Yanshan Petrochemical Group – Mr. DU at Yanshan, Beijing.

Interview 2, 1999, was conducted on May 12, 1999 with the vice president of Beijing Yanshan Petrochemical Group – Mr. YANG at Yanshan, Beijing.

Interview 3, 1999, was conducted on May 12, 1999 with the vice president of Beijing Yanshan Petrochemical Group – Mr. WANG at Yanshan, Beijing.

Interview 4, 1999, was conducted on May 13, 1999 with the marketing executive of Beijing Yanshan Petrochemical Group – Mr. LIU at Yanshan, Beijing.

Interview 5, 1999, was conducted on May 13, 1999 with the Human Resource executive of Beijing Yanshan Petrochemical Group – Mr. WANG at Yanshan, Beijing.

Interview 6, 1999, was conducted on May 13, 1999 with the general manager of Polypropylene Division – Mr. LIU at Yanshan, Beijing.

Interview 7, 1999, was conducted on November 15, 1999 with general manager of Ethylene Division – Mr. ZHAO at Yanshan, Beijing.

Interview 8, 1999, was conducted on November 15, 1999 with deputy general manager of Ethylene Division – Mr. HU at Yanshan, Beijing.

Interview 9, 1999, was conducted on November 15, 1999 with executive manufacturing of Ethylene Division – Mr. WEI at Yanshan, Beijing.

Interview 10, 1999, was conducted on November 16, 1999 with executive marketing of Ethylene Division – Mr. ZHANG at Yanshan, Beijing.

Interview 11, 1999, was conducted on November 17, 1999 with chief engineer of Ethylene Division – Mr. BI at Yanshan, Beijing.

Interview 12, 1999, was conducted on November 17, 1999 with executive personnel of Ethylene Division – Mr. YANG at Yanshan, Beijing.

Interview 13, 1999, was conducted on November 18, 1999 with general manager of Polyester Division – Mr. WANG at Yanshan, Beijing.

Interview 14, 1999, was conducted on November 18, 1999 with deputy general manager of Polyester Division – Mr. YANG at Yanshan, Beijing.

Interview 15, 1999, was conducted on November 19, 1999 with executive manufacturing of Polyester Division – Mr. LI at Yanshan, Beijing.

Interview 16, 1999, was conducted on November 19, 1999 with executive marketing of Polyester Division – Mr. LUO at Yanshan, Beijing.

Interview 17, 1999, was conducted on November 19, 1999 with chief engineer of Polyester Division – Mr. DONG at Yanshan, Beijing.

Interview 18, 1999, was conducted on November 22, 1999 with executive personnel of Polyester Division – Ms. WANG at Yanshan, Beijing.

Interview 19, 1999, was conducted on November 22, 1999 with general manager of Polypropylene Division – Mr. LIU at Yanshan, Beijing.

Interview 20, 1999, was conducted on November 22, 1999 with deputy general manager of Polypropylene Division – Mr. CUI at Yanshan, Beijing.

Interview 21, 1999, was conducted on November 23, 1999 with executive manufacturing of Polypropylene Division – Mr. SHUN at Yanshan, Beijing.

Interview 22, 1999, was conducted on November 23, 1999 with executive marketing of Polypropylene Division – Mr. WANG at Yanshan, Beijing.

Interview 23, 1999, was conducted on November 24, 1999 with chief engineer of Polypropylene Division – Mr. WANG at Yanshan, Beijing.

Interview 24, 1999, was conducted on November 24, 1999 with executive personnel of Polypropylene Division – Ms. ZHOU at Yanshan, Beijing.

Interview 25, 1999, was conducted on November 29, 1999 with general manager of Synthetic Rubber Division – Mr. FU at Yanshan, Beijing.

Interview 26, 1999, was conducted on November 29, 1999 with deputy general manager of Synthetic Rubber Division – Mr. ZHAO at Yanshan, Beijing.

Interview 27, 1999, was conducted on November 29, 1999 with executive manufacturing of Synthetic Rubber Division – Mr. ZHANG at Yanshan, Beijing.

Interview 28, 1999, was conducted on November 29, 1999 with executive marketing of Synthetic Rubber Division – Mr. LI at Yanshan, Beijing.

Interview 29, 1999, was conducted on November 30, 1999 with chief engineer of Synthetic Rubber Division – Mr. ZHAO at Yanshan, Beijing.

Interview 30, 1999, was conducted on November 30, 1999 with executive personnel of Synthetic Rubber Division – Mr. MA at Yanshan, Beijing.

Interview 31, 1999, was conducted on December 2nd, 1999 with general manager of Basic Chemical Division – Mr. ZHANG at Yanshan, Beijing.

Interview 32, 1999, was conducted on December 2nd, 1999 with deputy general manager of Basic Chemical Division – Mr. ZHU at Yanshan, Beijing.

Interview 33, 1999, was conducted on December 2nd, 1999 with executive manufacturing of Basic Chemical Division – Mr. ZHANG at Yanshan, Beijing.

Interview 34, 1999, was conducted on December 3rd, 1999 with executive marketing of Basic Chemical Division – Mr. WU at Yanshan, Beijing.

Interview 35, 1999, was conducted on December 3rd, 1999 with chief engineer of Basic Chemical Division – Mr. HU at Yanshan, Beijing.

Appendix E

Recommended Reading List from Local Strategic Management Literature by Leading Chinese Scholars of SOE Research

1. 方府楼, 刘树成 著, 1998, 论中国国有产业调整和企业改革的新纪元, 中国经济管理出版社
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5. 王洛林, 张卓元, 周济 著, 1999, 论商业竞争战略与国有企业经营管理, 中国人民大学出版社
6. 袁纲明 著, 1999, 大转变 - 国有企业管理改革的沉思录, 中国教育出版社
7. 何广亮, 李萍 著, 1999, 国有企业改革研究丛书 - 产业分布与资产重组, 中国人民大学出版社
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9. 李长安, 方府楼 著, 1999, 国有企业改革研究丛书 - 技术进步与发展方向, 中国人民大学出版社
10. 刘鸿儒, 唐宗盛 著, 1999, 国企集团制改革 - 制度与效率, 中国计划出版社
11. 李长安 著, 1999, 大调整 - 国有企业组织结构改革的六大难题, 中国教育出版社
12. 王洛林, 袁纲明 著, 1999, 论大型国有企业的战略经营管理 - 问题与反思, 中国人民大学出版社
13. 沈炳熙 著, 1999, 中国现代企业集团 - 模式构想与道路选择, 北京经济研究出版社

Appendix F

Performance Outcomes of 5 SBUs' Business Operations since MES Reform

Table 6.13 Performance Outcomes of Ethylene Division's Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	3,599,291	3,014,336	2,541,468
Costs of Production	(3,065,483)	(2,461,366)	(2,210,744)
Gross profit	533,808	552,970	330,724
Selling, general and administrative expenses	(244,142)	(270,180)	(221,147)
Operating profit	289,666	282,790	109,577
Financial expenses, net	(45,031)	(45,960)	(28,943)
Other (expenses) income, net	(10,593)	4,630	944
Profit before taxation	234,042	241,460	81,578
Taxation	(74,073)	(79,681)	(26,920)
Net profit	159,969	161,779	54,658

Figure 6.8 Sales Record of Ethylene Division 1996 - 2000

(RMB Million)

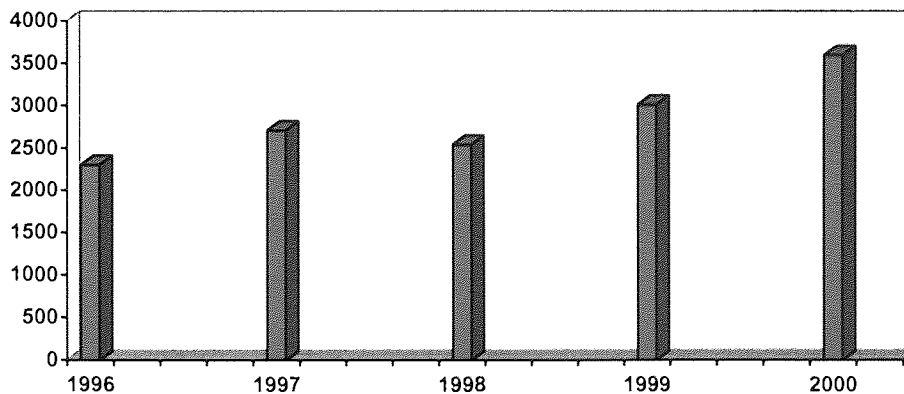


Figure 6.9 Operating Profit & Net Profit Record of Ethylene Division 1996 - 2000
(RMB Million)

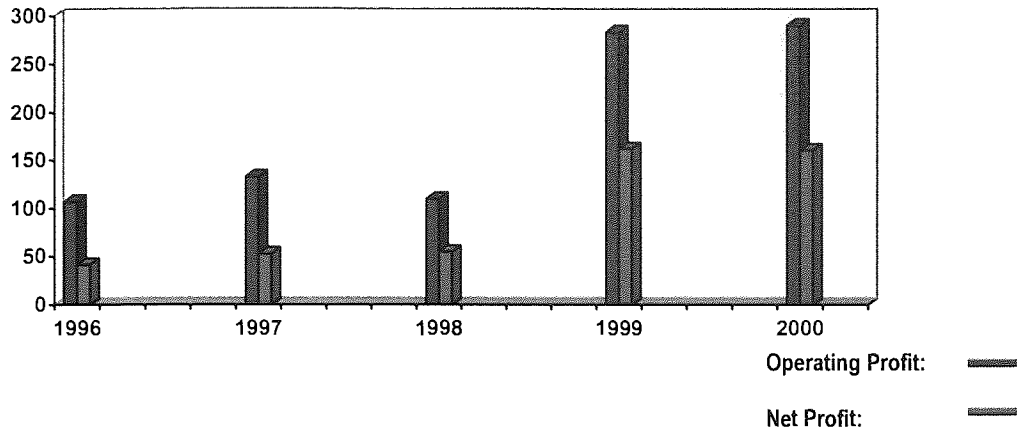


Table 6.14 Performance Outcomes of Polyester Division's Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	610,314	445,373	344,605
Costs of Production	(519,799)	(363,671)	(299,761)
Gross profit	90,515	81,702	44,844
Selling, general and administrative expenses	(41,398)	(39,919)	(29,986)
Operating profit	49,117	41,783	14,858
Financial expenses, net	(7,636)	(6,790)	(3,924)
Other (expenses) income, net	(1,796)	684	128
Profit before taxation	39,685	35,677	11,062
Taxation	(12,560)	(11,773)	(3,650)
Net profit	27,125	23,904	7,412

Figure 6.10 Sales Record of Polyester Division 1996 - 2000

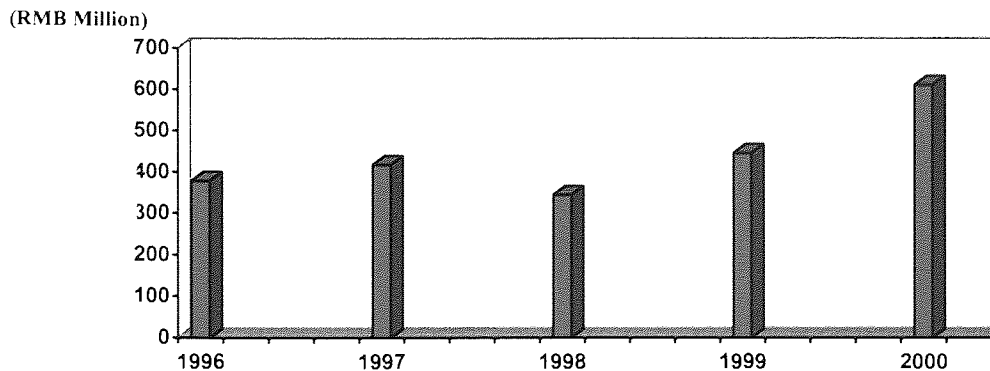


Figure 6.11 Operating Profit & Net Profit Record of Polyester Division 1996 - 2000
(RMB Million)

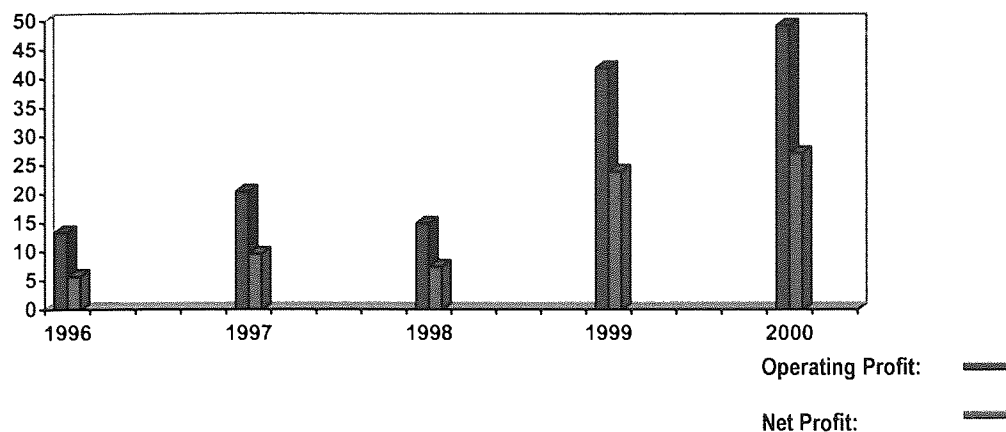


Table 6.15 Performance Outcomes of Polypropylene Division's Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	1,337,997	1,181,206	963,819
Costs of Production	(1,139,559)	(964,518)	(838,396)
Gross profit	198,438	216,688	125,423
Selling, general and administrative expenses	(90,757)	(105,873)	(83,867)
Operating profit	107,681	110,815	41,556
Financial expenses, net	(16,739)	(18,010)	(10,976)
Other (expenses) income, net	(3,938)	1,814	358
Profit before taxation	87,004	94,619	30,938
Taxation	(27,535)	(31,224)	(10,209)
Net profit	59,469	63,395	20,729

Figure 6.12 Sales Record of Polypropylene Division 1996 - 2000

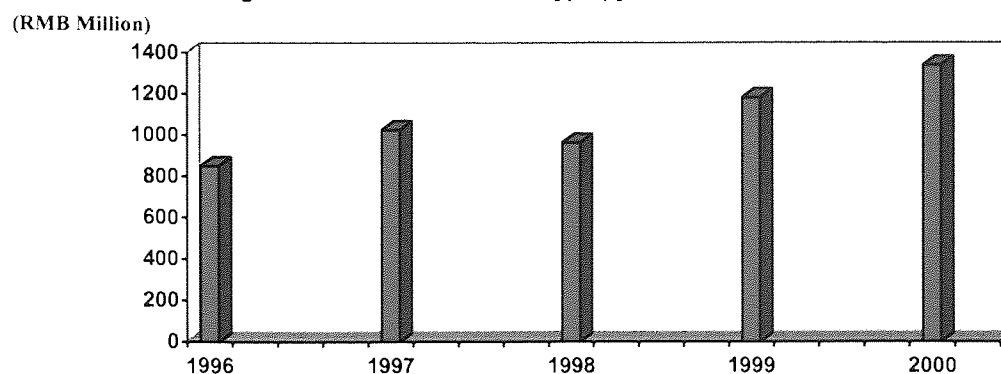


Figure 6.13 Operating Profit & Net Profit Record of Polypropylene Division 1996 - 2000
(RMB Million)

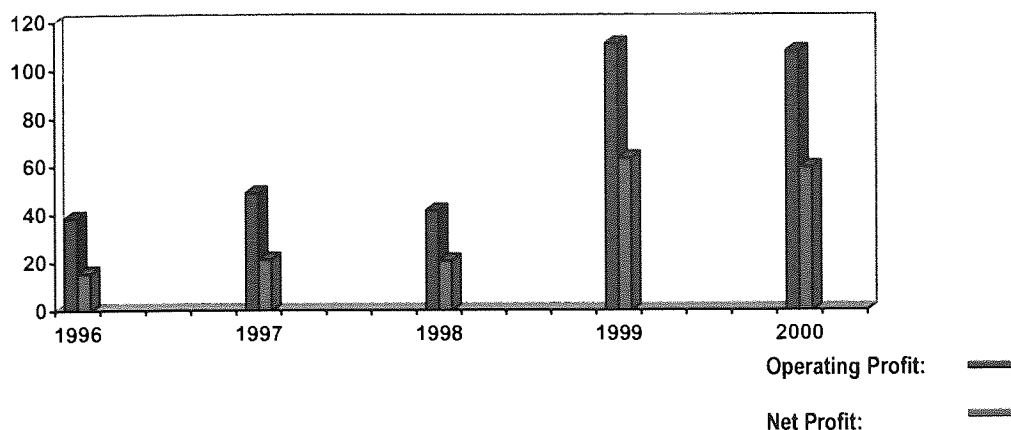


Table 6.16 Performance Outcomes of Synthetic Rubber Division's Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	946,770	806,835	850,745
Costs of Production	(806,355)	(658,824)	(740,037)
Gross profit	140,415	148,011	110,708
Selling, general and administrative expenses	(64,219)	(72,318)	(74,028)
Operating profit	76,196	75,693	36,680
Financial expenses, net	(11,845)	(12,302)	(9,688)
Other (expenses) income, net	(2,786)	1,239	316
Profit before taxation	61,565	64,630	27,308
Taxation	(19,484)	(21,328)	(9,011)
Net profit	42,081	43,302	18,297

Figure 6.14 Sales Record of Synthetic Rubber Division 1996 - 2000
(RMB Million)

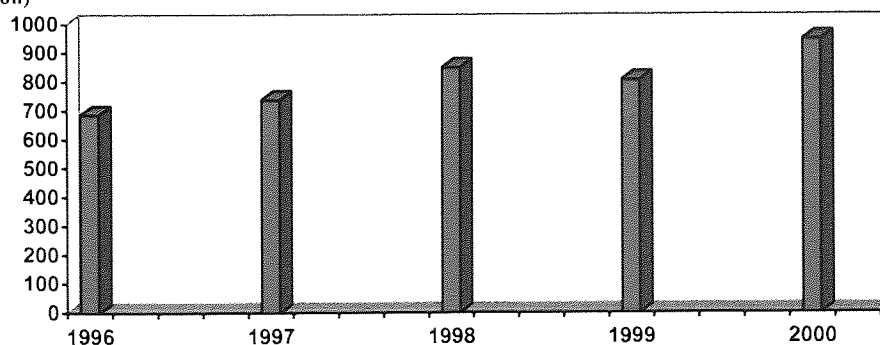


Figure 6.15 Operating Profit & Net Profit Record of Synthetic Rubber Division 1996 - 2000
(RMB Million)

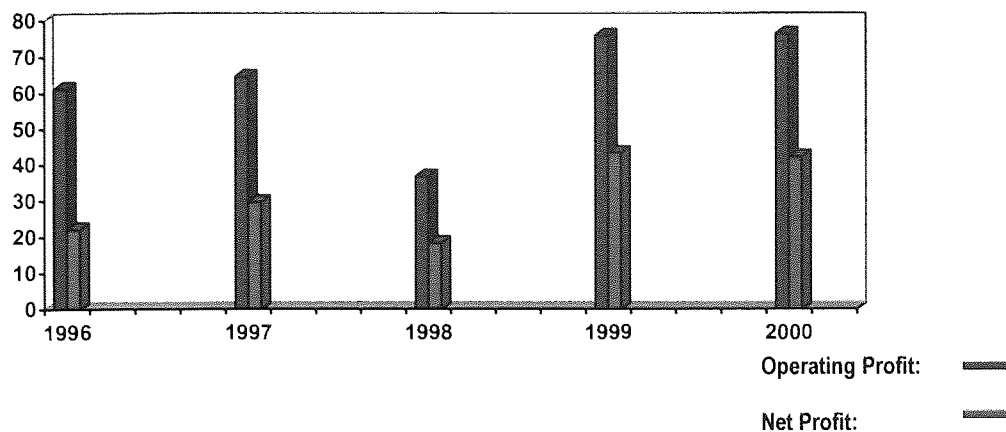


Table 6.17 Performance Outcomes of Basic Chemical Division's Business Operations since MES Reform

	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Sales	1,064,138	839,108	683,827
Costs of Production	(906,316)	(685,176)	(594,840)
Gross profit	157,822	153,932	88,987
Selling, general and administrative expenses	(72,181)	(75,210)	(59,503)
Operating profit	85,641	78,722	29,484
Financial expenses, net	(13,313)	(12,794)	(7,787)
Other (expenses) income, net	(3,132)	1,289	254
Profit before taxation	69,196	67,217	21,951
Taxation	(21,899)	(22,181)	(7,243)
Net profit	47,297	45,036	14,708

Figure 6.16 Sales Record of Basic Chemical Division 1996 - 2000
(RMB Million)

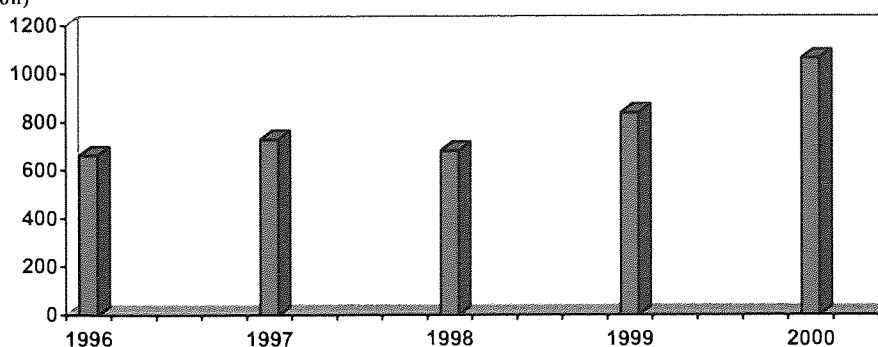
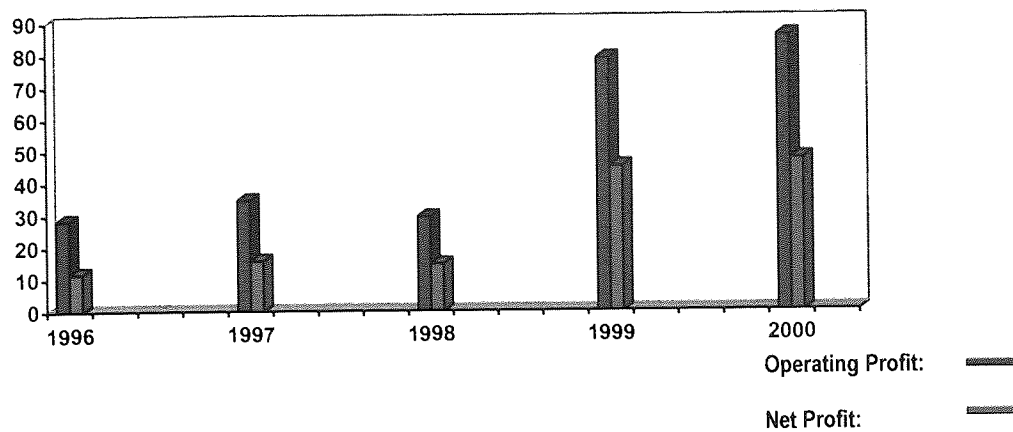


Figure 6.17 Operating Profit & Net Profit Record of Basic Chemical Division 1996 - 2000

(RMB Million)



Appendix G

Production Performance of 5 SBUs since MES Reform

Table 6.18

Ethylene Division	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Production Costs	3,065,483	2,461,366	2,210,744
Raw Material	2,122,540 (69.24%)	1,644,684 (66.82%)	1,416,423 (64.07%)
Utility Expenses	362,646 (11.83%)	251,551 (10.22%)	140,509 (9.92%)
Depreciation of Fixed Assets	236,348 (7.71%)	164,173 (6.67%)	143,035 (6.47%)
Repair & Maintenance Expenses	188,527 (6.15%)	265,089 (10.77%)	281,869 (12.75%)
Wages & Bonus	32,187 (1.05%)	23,875 (0.97%)	17,907 (0.81%)
Administrative Expenses & Other	122,312	111,253	131,539
Overheads	(3.99%)	(4.52%)	(5.95%)

Table 6.19

	2000	1999	1998
Capacity Utilization Rate of Major Production Facilities	(%)	(%)	(%)
- Ethylene Facility	117.93	108.15	99.75
- LDPE Facility	123.61	111.70	103.71
- HDPE Facility	119.95	106.99	102.15
- Ethylene Glycol Facility	96.39	89.87	75.43
- Polystyrene Facility	107.90	101.32	97.38

Table 6.20

	2000	1999	1998
Material Consumption Rate of Major Products	Kg/ ton	Kg/ ton	Kg/ ton
Ethylene			
- Cracking Feedstock	3303.95	3317.35	3366.75
LDPE			

- Ethylene	1021.71	1024.03	1029.03
HDPE			
- Ethylene	1023.92	1026.72	1026.93
Ethylene Glycol			
- Ethylene	666.38	668.33	671.35
- Oxygen	522.00	528.45	556.49

Table 6.21

	2000	1999	1998
	(RMB/Person)	(RMB/Person)	(RMB/Person)
Labour Productivity	75,392	60,805	51,684
The measurement used at the company is: Labour Productivity = Added Value (RMB Yuan) / Person			

Table 6.22

	2000	1999	1998
Major Products Conformance Quality against SINOPEC Standard	(%)	(%)	(%)
- LDPE			
Conforming Rate	42.27	26.35	57.87
First Grade Rate	36.63	63.04	36.73
Excellent Grade Rate	21.1	10.61	5.40
- HDPE			
Conforming Rate	5.30	5.01	3.74
First Grade Rate	4.18	7.78	9.20
Excellent Grade Rate	90.52	87.21	87.06
- Polystyrene			
Conforming Rate	15.39	25.26	46.16
First Grade Rate	2.40	0.78	1.66
Excellent Grade Rate	82.21	73.96	52.18
- Ethylene Glycol			
Conforming Rate	3.15	4.82	8.87
First Grade Rate	87.06	91.87	88.94
Excellent Grade Rate	9.79	331	2.19

Table 6.23

Polyester Division	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Production Costs	519,799	363,671	299,761
Raw Material	368,745 (70.94%)	250,278 (68.82%)	201,049 (67.07%)
Utility Expenses	61,804 (11.89%)	41,640 (11.45%)	29,826 (9.95%)
Depreciation of Fixed Assets	34,878 (6.71%)	24,256 (6.67%)	19,394 (6.47%)
Repair & Maintenance Expenses	26,613 (5.12%)	28,257 (7.77%)	29,226 (9.75%)
Wages & Bonus	5,094 (0.98%)	3,382 (0.93%)	2,158 (0.72%)
Administrative Expenses & Other Overheads	22,819 (4.39%)	15,856 (4.36%)	18,105 (6.04%)

Table 6.24

	2000	1999	1998
Capacity Utilization Rate of Major Production Facilities	(%)	(%)	(%)
- Xylene Facility	102.29	100.16	99.05
- Oxidation Facility	97.97	96.76	83.17
- Condensation polymerisation Facility	100.31	97.49	92.75
- HIV PET Facility	90.28	86.80	77.40

Table 6.25

	2000	1999	1998
Material Convention Rate of Major Products	Kg/ ton	Kg/ ton	Kg/ ton
Standard PET			
- Terephthalic acid	871.73	877.37	882.06
- Ethylene glycol	351.64	366.68	383.36
- Antimony acetate	0.48	0.52	0.55
HIV PET			
- PET chip	1040.04	1043.31	1046.42

Table 6.26

	2000	1999	1998
	(RMB/Person)	(RMB/Person)	(RMB/Person)
Labour Productivity	62,517	47,452	38,267
The measurement used at the company is: Labour Productivity = Added Value (RMB Yuan) / Person			

Table 6.27

	2000	1999	1998
Major Products Conformance Quality against SINOPEC Standard	(%)	(%)	(%)
- Bright polyester chip			
Conforming Rate	7.58	8.64	10.25
First Grade Rate	91.84	91.36	89.75
Excellent Grade Rate	0.58	-	-
- Semi-delustering polyester chip			
Conforming Rate	6.65	11.27	15.69
First Grade Rate	90.76	87.58	83.89
Excellent Grade Rate	2.59	1.15	0.42
- PIA copolymerization polyester chip			
Conforming Rate	5.14	5.21	12.87
First Grade Rate	93.25	94.79	87.13
Excellent Grade Rate	1.61	-	-
- HIV polyester chip			
Conforming Rate	3.15	3.82	3.97
First Grade Rate	90.06	89.87	89.84
Excellent Grade Rate	6.79	6.31	6.19

Table 6.28

Basic Chemical Division	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Production Costs	906,316	685,176	594,840
Raw Material	653,816 (72.14%)	478,458 (69.83%)	392,891 (66.05%)
Utility Expenses	107,489 (11.86%)	78,178 (11.41%)	65,075 (10.94%)
Depreciation of Fixed Assets	61,448 (6.78%)	45,358 (6.62%)	39,140 (6.58%)
Repair & Maintenance Expenses	35,527 (3.92%)	46,386 (6.77%)	57,521 (9.67%)
Wages & Bonus	8,610 (0.95%)	6,235 (0.91%)	4,877 (0.82%)
Administrative Expenses & Other Overheads	39,424 (4.35%)	30,558 (4.46%)	35,333 (5.94%)

Table 6.29

	2000	1999	1998
Capacity Utilization Rate of Major Production Facilities	(%)	(%)	(%)
- Phenol Facility	124.20	121.31	117.55
- Acetone Facility	126.42	123.85	116.41
- Meta-cresol facility	132.97	121.86	122.87

Table 6.30

	2000	1999	1998
Material Convention Rate of Major Products	Kg/ ton	Kg/ ton	Kg/ ton
Phenol-acetone			
- Benzene	925.89	964.56	966.58
- Propylene	530.33	540.05	565.93
Meta-cresol			
- Benzene	1005.04	1018.99	1027.24
- Propylene	542.66	573.55	587.11

Table 6.31

	2000	1999	1998
	(RMB/Person)	(RMB/Person)	(RMB/Person)
Labour Productivity	33,072	18,671	14,576
The measurement used at the company is: Labour Productivity = Added Value (RMB Yuan) / Person			

Table 6.32

	2000	1999	1998
Major Products Conformance Quality against SINOPEC Standard	(%)	(%)	(%)
- Phenol			
Conforming Rate	0.42	3.23	5.65
First Grade Rate	-	1.06	6.65
Excellent Grade Rate	99.58	95.71	87.7
- Acetone			
Conforming Rate	1.01	2.24	0.96
First Grade Rate	2.47	4.33	7.66
Excellent Grade Rate	96.52	93.43	91.38
- Meta-cresol			
Conforming Rate	2.02	-	-
First Grade Rate	3.78	-	-
Excellent Grade Rate	94.2	-	-
- BHT			
Conforming Rate	3.15	-	-
First Grade Rate	0.06	-	-
Excellent Grade Rate	96.79	-	-

Table 6.33

Synthetic Rubber Division	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Production Costs	806,355	658,824	740,037
Raw Material	582,510 (72.24%)	452,085 (68.62%)	541,485 (73.17%)
Utility Expenses	96,843 (12.01%)	76,621 (11.63%)	58,684 (7.93%)
Depreciation of Fixed Assets	54,187 (6.72%)	50,136 (7.61%)	41,220 (5.57%)
Repair & Maintenance Expenses	29,109 (3.61%)	44,602 (6.77%)	56,834 (7.68%)
Wages & Bonus	7,821 (0.97%)	6,127 (0.93%)	5,994 (0.81%)
Administrative Expenses & Other Overheads	35,157 (4.36%)	29,251 (4.44%)	35,817 (4.84%)

Table 6.34

	2000	1999	1998
Capacity Utilization Rate of Major Production Facilities	(%)	(%)	(%)
- DMF Facility	102.33	100.47	93.92
- Cis-polybutadiene Facility	130.29	119.29	104.73
- SBS Facility	106.17	101.24	97.31

Table 6.35

	2000	1999	1998
Material Convention Rate of Major Products	Kg/ ton	Kg/ ton	Kg/ ton
Cis-polybutadiene			
- Butadiene	1009.71	1010.08	1024.53
SBS			
- Butadiene	630.56	656.42	677.11
- Styrene	420.35	465.21	510.42

Table 6.36

	2000	1999	1998
	(RMB/Person)	(RMB/Person)	(RMB/Person)
Labour Productivity	97,500	85,952	61,287
The measurement used at the company is: Labour Productivity = Added Value (RMB Yuan) / Person			

Table 6.37

	2000	1999	1998
Major Products Conformance Quality against SINOPEC Standard	(%)	(%)	(%)
- Cis-polybutadiene Rubber			
Conforming Rate	5.52	6.28	-
First Grade Rate	93.39	93.16	-
Excellent Grade Rate	1.09	0.56	-
- SBS			
Conforming Rate	10.25	14.25	15.86
First Grade Rate	88.37	84.58	83.72
Excellent Grade Rate	1.38	1.17	0.42
- Butyl Rubber			
Conforming Rate	14.35	17.12	17.77
First Grade Rate	79.06	76.77	75.94
Excellent Grade Rate	6.59	6.11	6.29

Table 6.38

Polypropylene Division	2000	1999	1998
	(RMB'000)	(RMB'000)	(RMB'000)
Production Costs	1,139,559	964,518	838,396
Raw Material	773,418 (67.87%)	642,851 (66.65%)	518,715 (61.87%)
Utility Expenses	138,228 (12.13%)	101,853 (10.56%)	89,037 (10.62%)
Depreciation of Fixed Assets	88,885 (7.78%)	63,658 (6.60%)	55,669 (6.64%)
Repair & Maintenance Expenses	73,501 (6.45%)	102,721 (10.65%)	107,901 (12.87%)
Wages & Bonus	14,814 (1.30%)	8,777 (0.91%)	6,874 (0.82%)
Administrative Expenses & Other Overheads	48,887 (4.29%)	44,657 (4.63%)	60,196 (7.18%)

Table 6.39

	2000	1999	1998
Capacity Utilization Rate of Major Production Facilities	(%)	(%)	(%)
- Polypropylene Facility 1	85.37	78.42	65.17
- Polypropylene Facility 2	152.60	140.07	137.44
- Polypropylene Facility 3	93.92	93.52	87.81
- Pelletization Facility	94.26	89.12	78.42

Table 6.40

	2000	1999	1998
Material Consumption Rate of Major Products	Kg/ ton	Kg/ ton	Kg/ ton
Polypropylene Resin			
- Propylene	1035.33	1053.00	1071.63
- Ethane	44.15	70.26	88.01
- Electricity	431.80kwh	644.98kwh	713.71kwh

Table 6.41

	2000	1999	1998
	(RMB/Person)	(RMB/Person)	(RMB/Person)
Labour Productivity	58,111	54,872	47,292
The measurement used at the company is: Labour Productivity = Added Value (RMB Yuan) / Person			

Table 6.42

	2000	1999	1998
Major Products Conformance Quality against SINOPEC Standard	(%)	(%)	(%)
- Polypropylene Fibre			
Conforming Rate	5.71	15.59	25.48
First Grade Rate	8.51	15.13	17.23
Excellent Grade Rate	85.78	69.28	57.29
- Polypropylene Copolymer			
Conforming Rate	6.88	9.91	15.69
First Grade Rate	5.73	14.57	38.78
Excellent Grade Rate	87.39	75.52	45.53
- Polypropylene Medical			
Conforming Rate	10.13	40.76	-
First Grade Rate	41.23	11.39	-
Excellent Grade Rate	48.64	47.85	-
- Polypropylene Automobile			
Conforming Rate	51.87	-	-
First Grade Rate	26.51	-	-
Excellent Grade Rate	21.62	-	-