

The growth of hidden champions in China: a cognitive explanation from integrated view

Hidden
champions in
China

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Abstract

Purpose – There is a research gap in strategic management regarding the complement from managerial cognition literature to the behavioral theory of firm, as well as linkage between cognitive structure and cognitive process of strategy formulation in the field of managerial cognition, which also calls for further exploration. The purpose of this paper is to construct a model from an integrated view for explaining the process of cognitive reconstruction under incremental changes.

Design/methodology/approach – Qualitative research is conducted in the form of 17 semi-structured interviews in four hidden champions operating in China. Based on the model generated from the literature review, this paper adopts the abductive logic for data analysis.

Findings – This paper draws the following conclusions. The cognitive structure is shaped by the changing environment and the performance feedback, the variance in structural attributes will affect whether the changing environment destructs the effectiveness of original cognitive structure or not, the centrality of cognitive structure will promote the efficiency of tried-and-true organizational adaptations to incremental changes, and cognitive structure reconstruction is the result of the recursive process of trial-and-error learning.

Originality/value – This paper proposes the model explaining the interaction mechanisms between cognitive structure and strategy formulation process. It also presents the iterative sense-making process for reconstructing cognitive structure in strategy formulation. Both of them extend the understanding on managerial cognition in organizational adaptations to incremental environmental changes.

Keywords Managerial cognition, Strategy formulation, Cognitive structure, Hidden champions, Incremental changes

Paper type Research paper

1. Introduction

Hidden champions are highly successful companies occupying global top three in terms of market share in their niche markets (Simon, 1992, 1996). Germany is well-known for a large number of hidden champions, and this specific group of companies is regarded as a central pillar of its economy (Witt and Carr, 2014) with a stabilizing effect in the aftermath of economic crises. Since such companies are rooted in a focused strategy with soft diversification and continuous innovation (Din *et al.*, 2013), most of them are located in a specific niche market within industries of long life-cycle. In China, >40years of development since the reform and opening-up has transformed it from a planned economy to a market economy with continuously environmental changes. Therefore, the growth of hidden champions under such context should make organizational adaptations to the changing environment, although their industry has not witnessed a significant paradigm shift.



It is widely accepted in the literature that organizations need to undertake both incremental, exploitative changes and radical, exploratory changes (Uotila, 2018). Behavioral theory of the firm (BTOF) (Cyert and March, 1963) is a key theory in strategic management that focuses on a firm's strategic change. It tells a story of performance feedback that relates to social comparison and historical comparison driving strategic change (Cyert and March, 1963; Greve, 1998; Kacperczyk *et al.*, 2015). Following studies find that comparison and feedback are affected by self-assessment, self-enhancement (Lucas *et al.*, 2018; Wood, 1989), historical risk (Bolton, 1993) and growth history (Levinthal and March, 1981). However, existing BTOF researches pay little attention on cognition diversity in sensing the problems, which indicates that the cognitive biases at the individual level may determine whether the environmental changes might attract further organizational adaptations (Hambrick and Finkelstein, 1987; Walsh, 1995). Specifically, in managerial cognition literatures, there emerged numerous studies on problem sensing in changing environments from the 1980s (Kiesler and Sproull, 1982; Weick, 1988). It is shown that organizations with similar assets might respond differently to the same environmental shift when their top managers' attentional patterns differ (Osborne *et al.*, 2001) because cognitive limits prevent top managers from developing a complete understanding of their environments (Bogner and Barr, 2000). The managerial literature could be divided into two streams: cognitive structures that are simplified knowledge structures about how the business environment works (Gary and Wood, 2011) and the process of how top managers make sense of information and how they act to influence organizational strategy and outcomes (Shepherd *et al.*, 2017). However, the relationship between these two streams is still complex (Helfat and Peteraf, 2015), and it calls for further research to explain the linkage between them (Narayanan *et al.*, 2011). Given the complementary between the behavioral theory and the literature of managerial cognition, and the calls in managerial cognition research, the aim of this study is to construct a model from an integrated view to explain the process of cognitive reconstruction.

Furthermore, scholars seek to explain organizational adaptations from the cognitive view are mostly choosing the context of radical technological changes (Benner and Ranganathan, 2017; Eggers and Kaplan, 2009; Kahl and Grodal, 2016). The strategy formulation process towards radical changes can draw top managers' attention to environmental stimuli that are prominent but not strategically relevant (Kruglanski and Boyatzi, 2012), but it also blinds top managers to incremental changes. The era of incremental change is generally thought to deal with minor changes and fairly stable phenomena. It is accompanied by a general reduction of innovativeness and focus on cost reduction, minor component and subsystem innovation (Anderson and Tushman, 1990). Firms generally put their efforts in product customization for differentiated market segments and other forms of details (Lee and Berente, 2013). For firms operating in a relatively stable industry, the environment is more likely characterized with incremental changes (Abernathy and Utterback, 1978; Benner and Tushman, 2002). Take the incremental technological change as an example, it refers to a steady flow of technical improvements that are exploitative, build on an existing technological trajectory. Moreover, they are relatively minor, but it can be cumulatively important (Abernathy and Utterback, 1978; Levitt and March, 1988) and attention should also be given to the possibility that under some circumstances incremental change can be quite risky (McKendrick and Wade, 2010). Therefore, we addressed the following research question:

RQ1. How is the interaction between cognitive structure and strategy formulation process in cognitive reconstruction under incremental changes?

Our analysis is built on a qualitative study conducted in four Chinese hidden champions companies – specifically, 17 semi-structured interviews with top managers in case companies. This paper extends the understanding of the role of managerial cognition for organizational adaptations, with the integrated view of cognitive structure and strategy formulation process. Moreover, this paper provides some insights on how to develop an adaptive cognitive structure when meet incremental changes.

This paper is structured as follows. Section II introduces the literature review that sets the basic theoretical model. This is followed by Section III, clarifying the methodology we adopted, as well as the presentation of coding and measuring process. Section IV shows the main findings from the case analysis and puts forward several propositions. Finally, the final section contains discussion of the implications and suggestions for further research.

2. Literature review

2.1 *Managerial cognition and organizational adaptation*

During the past decades, many researchers have sought to explain organizational adaptation as the process decision-makers assess the changing environment then attempt to formulate strategic responses (Child, 1972; Miles *et al.*, 1978). To offer deeper insights, two streams of research emerged – one examining organizational capabilities and the other managerial cognition. The capabilities-based view believes that capabilities are the source of heterogeneity in organizational adaptation (Argyres *et al.*, 2012; Peteraf, 1993), among which dynamic capabilities have a relatively independent and direct impact on performance under turbulent changes (Karna *et al.*, 2016). Dynamic capability here is regarded as “a firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments” (Teece *et al.*, 1997). For laying out the micro-foundations of dynamic capabilities in tripartite form, Teece (2007) suggests a role for cognition in the “sensing,” “seizing” and “reconfiguring” components of dynamic capabilities. More specifically, dynamic managerial capabilities, focusing on corporate-level managerial decision, illustrate the adaptation process of reaching the optimal strategic choice under bounded rationality (Adner and Helfat, 2003). Furthermore, Helfat and Peteraf (2015) introduced the concept of “managerial cognitive capability,” which highlights the capacity of an individual manager to perform one or more of the mental activities that comprise cognition.

As organizational adaptation depends on how firms notice and process environmental cues (Chakravarthy, 1982), there emerged numerous research seeking to explain why some organizations adapt better and survive longer from the managerial problem-sensing view from the 1980s (Kiesler and Sproull, 1982). The underlying model is that strategic actions are shaped by how managers notice and interpret change, and then translate those perspectives into strategic choice (Daft and Weick, 1984). Furthermore, organizations with similar assets might respond differently to the same environmental shift when their top managers’ attentional patterns differ (Osborne *et al.*, 2001). The cognitive view provides a micro-processes explanation (Dutton and Dukerich, 1991) to the attention focus and environmental strategy causal logic (Nadkarni and Barr, 2008). More importantly, management cognition theory supplements and extends the motivation logic of BTOF by focusing on the attention of organization and its environment. BTOF has worked on examining firms’ behavior as a response to performance feedback (Cyert and March, 1963; Argote and Greve, 2007). Cyert and March (1963) put forward that firms will get feedback and derive expectation according to available information and make strategic decisions. One of the theoretical logics from BTOF studies is the capacity for risk-taking behavior, which argues that when performance is above the aspirational level, firms will start slack research and conduct risky strategic

activities (Chen and Miller, 2007; Xu *et al.*, 2019). The other logic shows when firms get negative performance feedback, they will conduct problematic search according to motivation logic (Xu *et al.*, 2019; March, 1988). However, limited by bounded rationality and uncertainty avoidance of managers, information acquisition and choice of search are biased (March and Simon, 1958; Cyert and March, 1963), which indicates that managers' attentions and perceptions will lead to differences in performance feedback and motivation.

Recently, researchers have developed a series of theoretical or empirical studies for discussing the importance of managerial cognition in changing environment, especially when facing radical technological change (Eggers and Kaplan, 2009; Kahl and Grodal, 2016; Tripsas and Gavetti, 2000), and we summarized key studies in Table I. However, in addition to the radical technological changes, there are incremental environmental changes in design

Authors	Journal	Type of change	Method	Research question
Benner and Ranganathan (2017)	OS	Radical technological change	Qualitative and Quantitative studies	How do analysts assess the strategies of incumbent firms following a radical technological change?
Eggers and Kaplan (2009)	OS	Radical technical change	Quantitative study	The conditions under which managerial cognition affects the timing of incumbent entry into a radical new technological market
Gavetti, 2005	OS	Radical technological change	Simulation	How routine-based and cognitive logics of action coexist within an organizational hierarchy to affect capability development?
Kahl and Grodal (2016)	SMJ	Radical technological change	Multilevel discourse analysis	Why firms fail in the face of radical technological change, and how customers develop their interpretations and evaluation criteria of the new technology?
Kaplan and Tripsas (2008)	AMJ	Radical technical change	Quantitative study	How CEO cognition, organizational capabilities and organizational incentives interacted to shape firm strategy during the fiber-optic revolution
Kaplan and Tripsas (2008)	RP	Technical change	Theoretical work	How could cognitive lens influence technology trajectories across the life cycle from the co-evolutionary model of technological frames and technology?
Kaplan <i>et al.</i> (2003)	ICC	Discontinuous technological change	Quantitative study	Explore the relationship between managerial recognition and strategic response in the case of significant discontinuity
Shepherd <i>et al.</i> (2017)	SMJ	Environmental change	Theoretical work	Explores how different modes of attentional engagement impact the likelihood of forming beliefs about radical and incremental opportunities requiring strategic action
Tripsas and Gavetti (2000)	AMJ	Radical technological change	Case study	How managerial cognition affects the evolution of capabilities and thus contributes to organizational inertia?
Vergne and Depeyre (2016)	AMJ	Environmental shift	Mix-methods	In an industry experiencing an environmental shift, how do managerial attention and asset reconfiguration contribute to firm adaptation – or lack thereof?

Table I.
Key studies on organizational adaptation from cognitive view at organizational level

Notes: AMJ = Academy of Management Journal; ICC = Industrial and Corporate Change; SMJ = Strategic Management Journal; OS = Organization Science; RP = Research Policy

components, consumer preferences, competitive dynamics and institutions consistent with current trajectories (Shepherd *et al.*, 2017).

For firms operating in a stable industry, especially manufacturers in industries of long life-cycle, their environment is more likely to be characterized by incremental changes (Abernathy and Utterback, 1978; Benner and Tushman, 2002); however, few studies, especially empirical studies, are designed for the context. Hidden champions, proposed by Hermann Simon as companies occupy the leading market position in the world or the mainland in their niche market (Simon, 1992, 1996), are a group of firms operating in such context. Under the dynamically evolving environment, studies about hidden champions' adaptation and growth primarily focused on market selection (Brkić and Berberović, 2013), factors that have contributed to their success (Voudouris and Lioukas, 2000), and product-related innovation strategies (Buse and Tiwari, 2014). From the cognitive view, studies only pointed out that hidden champions, with specialized business layouts, are "single-minded specialists" supported by centralized cognitive structure usually beat the "generalist" (Simon, 1996). Therefore, current researches lack a micro and a systematic process to explain how hidden champions adapt to incremental changes in the environment and gain competitive advantages.

2.2 Cognitive structure and strategy formulation

Cognition encompasses two meanings: one is cognitive process and the other is cognitive structure (Helfat and Peteraf, 2015). Following the definition, studies on managerial cognition and strategy could be divided into two streams. From the static view, researchers mainly focus on how constructs in cognitive structure are ordered and linked (Calori *et al.*, 1994; Kiss and Barr, 2015). Most researchers characterized the structural attributes by complexity and centrality (Kiss and Barr, 2015; Nadkarni and Narayanan, 2007). Complexity reflects the degree of differentiation and integration in which differentiation captures the number of constructs within a cognitive structure and integration describes the degree of interconnectedness among constructs (Walsh, 1995). Then, centrality captures the extent to which cognitive structures are centralized around a limited number of core constructs (Eden *et al.*, 1992).

Then, from the dynamic view, scholars move research beyond purely content issues to focus on cognitive processes (Bogner and Barr, 2000). Increasing emphasis has been placed on how top managers make sense of information and how they act to influence organizational strategy and outcomes (Shepherd *et al.*, 2017). Researchers describe strategy formulation as a complex process comprising scanning, interpreting and responding (Daft and Weick, 1984; Narayanan *et al.*, 2011). Scanning involves information gathering for important events or issues from the both external (Kiesler and Sproull, 1982) and internal environment (Cowan, 1986). Moreover, interpretation refers to the ways of comprehending the meaning of incoming information. Then, the effective organizational action depends on the scanning and subsequent interpretations of information. Such dynamic process continues to feedback and cycle, thus forming a path for firms to achieve superior performance (Winter, 2012). Emphasizing the process of cognition and strategy formation, Gavetti (2012) suggests that incremental sensibility and superior ability are important reasons for firm growth. Winter (2012) provides a different perspective of the capability paradigm, which suggests that, to stand out, firms need imagination to identification, grasp, recombination and action of distant opportunities. Dew (2009) proposed the concept of serendipity, highlighting that the discovery of some opportunities involves a genuine and non-trivial role for contingency as a trigger event. In the mode, the entrepreneurial phenomena involves treating contingencies as error terms that are essentially expunged

from the analysis, controlled for, or assumed away. Previously, in 1994, Meindl *et al.* (1994) listed “what is the relationship between cognitive structure and cognitive process” as one of the five key questions in cognition within and between organizations. Furthermore, Labianca *et al.* (2000) noted that although scanning is typically directed by cognitive structure, it may influence the cognitive structure of managers. Then, in the longitudinal case study of corporate entrepreneurship, Bhardwaj *et al.* (2006) concluded that both the process and content of scanning are accompanied by the creation of new cognitive structures. Researches on cognitive process and structure are not mutually exclusive, among which Gavetti and Levinthal (2000) further emphasized that the cognitive processes are forward-looking, and it is based on actors’ cognitive structure that is backward-looking, or experience based. Some central phenomena rely on the interface of these two logics, and could be only explained by considering them jointly (Gavetti and Levintal, 2000). However, because the relationship between cognitive structure and processes is complex (Helfat and Peteraf, 2015), when Narayanan *et al.* (2011) reviewed the literatures on strategic cognition, they still figured out the theoretical puzzle pertaining to the linkage between cognitive structure and process of strategy formulation. Therefore, this study aims to explore the interactive relation between the two, especially when organizations facing the changing environment.

2.3 Basic research model

Hypercompetitive environments are characterized by rapid changes such as technology and regulation, relative ease of entry and exit by rival firms and ambiguous consumer demands. The model of Bogner and Barr (2000) provides an initial process idea to demonstrate the cognitive, processing and action processes of a firm in a hypercompetitive environment. It pointed out the common concepts in industry recipes: developing cognitive diversity, implementing rapid decision making and making experimental action; moreover, it still suggests a need to investigate the role of process concepts in cognitive structure. From the process perspective in cognition research, cognitive structures are an ex ante part (Kaplan, 2011) of the decision-making process that produces strategic decisions, thus defining the nature of the problems around which strategic actions will take place. The work of Bogner and Barr (2000) provides the base for further research on investigating the presence and role of process concepts in cognitive frameworks. Therefore, adapted from Bogner and Barr (2000)’s research on making sense in hypercompetitive environments, the basic model underlying this study can be represented as a scanning-interpretation-action sequence (Figure 1). Most of top managers’ existing cognitive structures are eroded in the organizational adaptation process, and the effectiveness of cognitive structure is destructed. It drives the “adaptive sensemaking” to manage changes, which also means that the cognitive mechanisms in such processes require engagement with the situated and interactive nature of cognition (Kaplan, 2011).

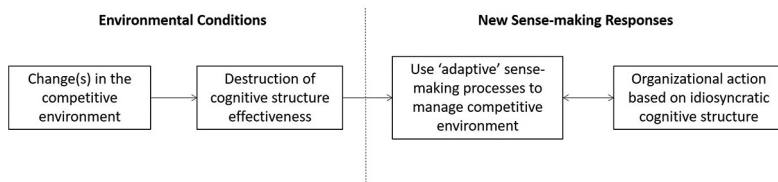


Figure 1.
Basic research model
for abductive
analysis

Source: Adapted from Bogner and Barr (2000)

3. Methodology

3.1 Research method

Given the research question for this study is to explore and explain “how” and “why” (Yin, 2017) of the relation between cognitive structure and cognitive process during the incremental changes, a qualitative research approach was adopted to address the theory building nature of this study. Although single-case study could richly describe the existence of a phenomenon, multiple cases create more robust theory because the propositions are more deeply grounded in varied empirical evidence (Eisenhardt and Graebner, 2007). Therefore, we opted for the multi-case study, which enables broader exploration of our research question and theoretical elaboration. Given the exploratory nature of the study, the study applied an abductive logic in data analysis (Dubois and Gadde, 2002). It is an iterative process of moving back and forth within the literature and data to find a possible matching framework or to extend the theory used prior to our observations (Spens and Kovács, 2006). Following recommendations on 12 transparency criteria proposed by Aguinis and Solarino (2019), we listed our steps in Table II for enhancing the transparency and replicability of qualitative research.

3.2 Data collection

Based on the existed literature, the aim of this paper is to construct a model from an integrated view to explain the process of cognitive reconstruction. Unlike organizational adaptations toward radical technological changes, adaptations to incremental change better describe gaining sustainable advantage in industries with a long cycle, which provides a relatively stable competitive environment. Hidden champions are companies rooted in a focused strategy with continuous innovation (Din *et al.*, 2013), and most of them are located in a specific niche market within industries of long life-cycle, which have not witnessed

Transparency criterion	Details
1. Kind of qualitative method	multi-case study
2. Research setting	development of hidden champion firms in China when meet incremental changes
3. Position of researcher along the insider-outsider continuum	development of close relationships during the course of data collection
4. Sampling procedures	Given the variation among cases, we conduct the purposive sampling by including both process and discrete manufacturers, parts and integrated system manufacturers
5. Relative importance of the participants/cases	One interviewee from firm B has got PhD in management
6. Documenting interactions with participants	Face-to-face interview with recordings
7. Saturation point	data collection completed until theoretical saturation was reached in data analysis
8. Unexpected opportunities, challenges and other events	/
9. Management of power imbalance	/
10. Data coding and first-order codes	Data collected were coded thematically via Nvivo
11. Data analysis and second-or higher-order codes	Coding schemes were discussed by the research team through the whole iterative data analysis process, with coders coded independently
12. Data disclosure	Transcription and recordings are available by request

Table II.
Steps for enhancing
transparency and
replicability

significant paradigm shifts. They provide the appropriate context of studying the cognitive reconstruction in incremental change.

We chose our case companies from manufacturing in China, and these companies are hidden champions as they successfully adapted to the most incremental changes during the developing process. Then, given the variation among cases, the four cases in our study include both process and discrete manufacturers, parts and integrated system manufacturers. Table III describes their basic information. In total 17 semi-structured interviews were conducted with founders, CEOs or top managers in the 4 companies over an 11-month period from December 2016 onward. Each interview was attended by more than two researchers for realizing observer triangulation (Stake, 1995) and to monitor or correct each other's interaction with the interviewee. The usage of multiple interviewers is a common, and strongly advised, approach to elicit meaningful responses from the interviewee and to detect inconsistencies and digressions better during the interview and be able to respond to it (Kincaid and Bright, 1957; Huber and Power, 1985; Mann *et al.*, 2013). The open-ended questions (Table IV) remained the same to ensure that all interviewee were

Table III.
Basic information of case companies

Case	A	B	C	D
Establishment	1994	1980	1988	2000
City	Jinhua	Taizhou	Shaoxing	Huzhou
Employees	400+	3338	5613	1416
Main product	Drinking straws	Gears	Vitamin	Electric Stacker
Sales (Billions RMB)	0.10	1.74	4.70	1.15
Market share	No. 1 globally	No. 1 in China	No. 1 globally	No. 1 in China
Number of interviews	5	4	3	5

Table IV.
Question list for interview

Q.	Summary of key themes	Intended purpose
1-4	Interviewee introductory questions: organization, job title, areas of responsibility, time in position;	For general information (to ensure sufficient expertise/knowledge levels) and to warm up the interview;
5	Background information on company/organization;	Contextual information;
6-7	Understanding of the environment that their firm operates in; Self-description of the incremental changes in their external environment during firm development;	Information on their cognitive structure, and the incremental changes of their environment;
8-9	The triggers/barriers in the company/organization to develop strategic actions when facing incremental changes; The links between the environmental changes and firm development from their understanding;	Information on the key determinants for the process of developing strategic adaptation to incremental changes, and the changes in cognitive structure of decision-makers
10-12	Related capabilities and resources: skills, experience, talent, etc.	Information on organizational capability to develop strategic response;
13-14	Process of strategy formulation for responding to the incremental changes; the changes in firm growth after adopting the strategic actions;	Information on the development of strategic actions as responses to incremental changes, and the results in firm performance after adopting such actions

asked the same baseline questions. Depending on the interviewee's response, each interview contained other follow-up questions.

The average length of interviews lasts 74 min, and we get the document of 289,597 words after transcription. Although interviews are useful in capturing details of cognitive structure at one point in time, they were not as useful in capturing longitudinal perspectives for the risk of retrospective bias (Kaplan, 2011). Therefore, we also collected archival documents and information from the websites, news or articles. Multiple sources of data meet the requirements of triangulation, improving the reliability of our study.

3.3 Data analysis and coding

All the data collected were coded thematically via Nvivo and our initial coding schemes were based on the basic model generated from the literature review. The coding schemes were discussed by the research team through the whole iterative data analysis process with two members of our research team coded independently until theoretical saturation was reached (Shah and Corley, 2006). Inter-rater reliability here is 0.945 following the Holsti method, which represents good agreement between the two coders. Figure 2 shows the coding procedures of the strategy formulation process, and Table V presents the strategies in methodology for ensuring the reliability and validity. The first-order concepts on the left side are "concepts-in-use" (Gephart, 2004, p. 455), representing language used by interviewees. Moreover, the second-order constructs are identified among the first-order concepts, which allowed us to lift the data to a conceptual level (Suddaby, 2006). Finally, second-order concepts are aggregated into constructing the adapted research model.

Then, for the cognitive structure, following Nadkarni and Narayanan (2007), we traced causal maps from the transcription document into a five-step procedure, from identification of causal statement, construct raw causal maps, develop raw concepts, develop theoretical coding scheme, to recast raw concepts into the coded causal map (Figure 3). According to the procedure, we coded the causal map for each case firm on its longitudinal development and finally constructed the adaptive cognitive structure. Figure 4 shows the adaptive cognitive structure of Firm A as the example. Based on the causal map, the centrality of cognitive structure is measured by the degree to which knowledge or information about the environment revolves around one or more core constructs or is organized hierarchically. Furthermore, as indicated by Ozgen and Baron (2007) and Fernández-Pérez *et al.* (2016), complexity is measured with two items: a broad range of industry-related knowledge and information and high connectedness among industry-related concepts.

4. Findings

4.1 Adaptive cognitive structure

Scholars realized that cognitive structures could change over time (Labianca *et al.*, 2000), particularly when the information environment is dramatically altered (Isenberg, 1987) or the leader articulates a new vision for the organization (Bartunek *et al.*, 1992). From the analysis of cognitive structure, we find that the cognitive structures of four case firms change over time. We summarized the main changes of cognitive structural attributes for the 4 case firms in Table VI.

4.1.1 External and internal environment. Despite the fact that the relationship between strategy and external environment is highlighted as a central feature in strategy research (Nadkarni and Barr, 2008), the impact of environment on managerial cognition has not been addressed in previous studies. Actually, leaders in changing environment are sought to construct stories that could make sense of the unpredictable and ambiguous issues (Maitlis and Lawrence, 2007).

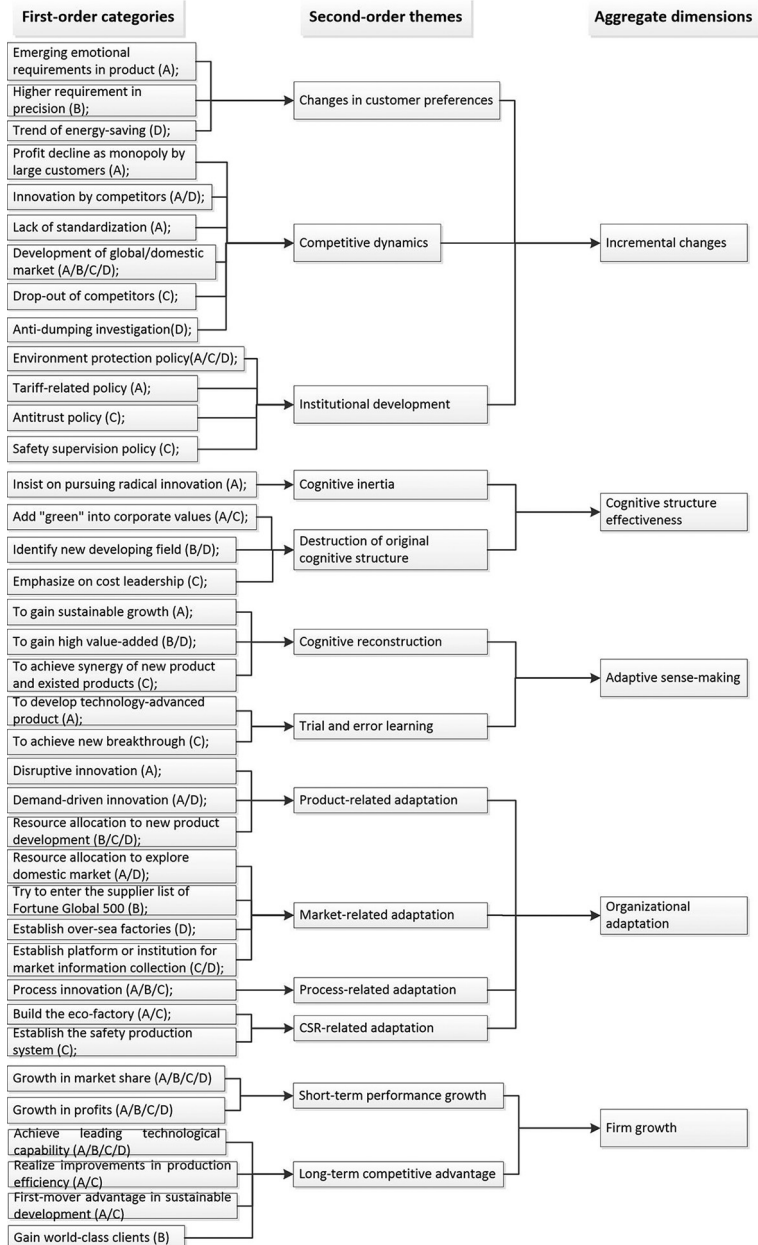


Figure 2.
Coding procedures
for the strategy
formulation process

For helping decision makers evaluate the legitimacy of a change initiative (Khan, 2018), the *institutional environment* acts as a sensemaking filter. We showed the representative quotations of institutional environment changes noticed by case firms in Table VII, and it is easy to find that the changes of environmental protection, tariff-related, antitrust, and safety supervision policies offer more stimulus to the existed cognitive structure. The complexity

Reliability and validity	Actions in case study	Stages
Reliability	Adopt protocol of case study Establish the database for ensuring the same conclusion for repeated study Testing analysis reliability	Research design Data collection Data analysis
Construct validity	Triangulation in data source Chain of evidence: Keywords-Quotations-Propositions-Model Verification of report: the work is read and verified by staffs in case firms	Data collection Data collection Writing
External validity	Conduct repeated researches through multi-case study	Research design

Table V. Strategies for ensuring reliability and validity

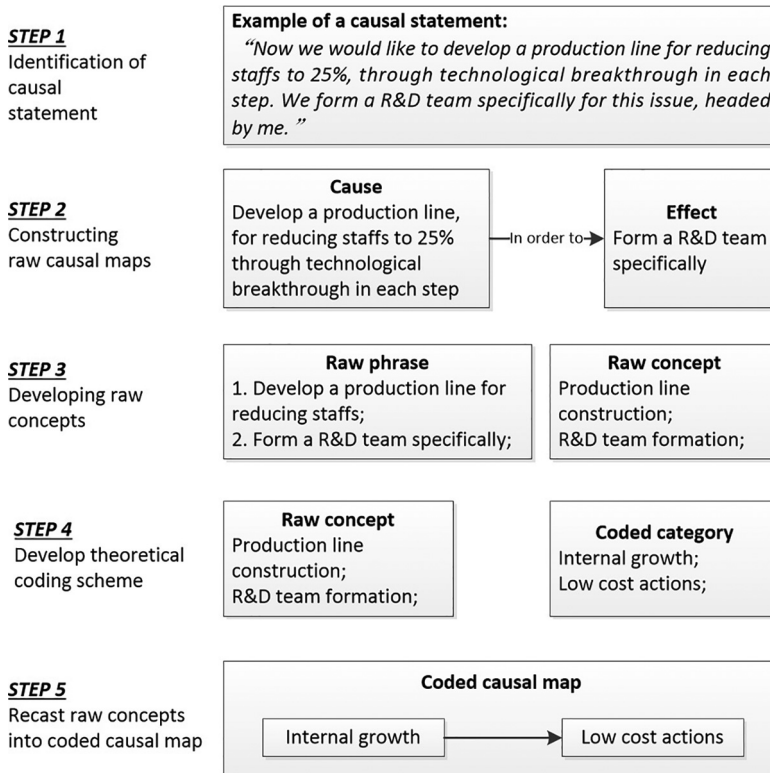


Figure 3. The five-step procedure of constructing causal maps

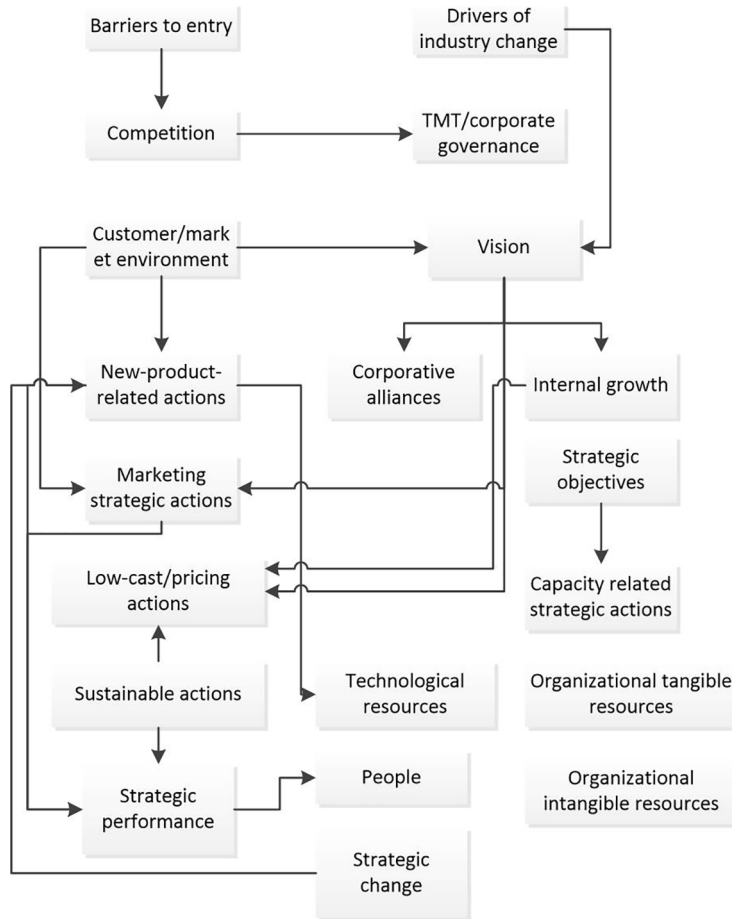


Figure 4.
Coding for the
adaptive cognitive
structure of Firm A

of cognitive structures could be further enhanced when the decision makers allocate attention to these aspects of incremental environmental changes expected to be relevant.

Similarly, the changes in the *competitive environment* also prompt decision-makers to allocate managerial cognition to new domains. As shown in Figure 1, the competitive environment changes of four case firms are mainly for the innovative behavior by competitors, lack of standardization in industry, the development of domestic market, the drop-out of competitors, and the anti-dumping investigation. For example, “many industry leaders turned to be devoted in the electric product development, which was a new direction for us” mentioned by the R & D manager of firm C shows that the changes of innovative behaviors by competitors enabled them to pay attention to electric series. Because managerial cognition will be shaped by externalities (Weick et al., 2005), the incremental changes in external environment lead to the changes in managerial cognition.

Researchers also stated that changes in the *internal environment*, like the new organizational structures, roles or relationships may trigger changes in managerial cognition (Balogun and Johnson, 2005). From the cases, we could find that the change of

Firm	Time	Main concerns	Changes in structural attributes	Incremental changes	Cognitive changes
A	1994-2001	Targeted at enlarging production capacity;	Centrality↑	Growing global market;	/
	2001-2003	Pay attention to exportation and sustainable development;	Complexity↑	Stricter environment protection policy;	DE: Add "green" into corporate values
	2004-2011	Centered on improving the quality of products;	Centrality↑	Profit decline as monopoly by large customers;	CI: Insist on pursuing disruptive innovation
	2011-	Intended to explore other industries for firm growth;	Complexity↑	Emerging emotional requirements in product;	DE: Developing effective and customer-centric innovation
B	1980-2000	Aiming at improving cost efficiency and product quality;	Centrality↑	Changes in customer preferences;	CI: Limited to develop in the field of motorbike
	2001-	Turned to applications in auto industry and other emerging fields;	Complexity↑		DE: Identify new developing field
C	1988-1999	Targeted at making a product with long-term demand of human beings;	Centrality↑	Improvement of living standards;	/
	2000-	Everyone has to be the information source, and gain leading power through competition;	Complexity↑	Antitrust policy published by Western countries, and competitors dropped out;	DE: Emphasize on cost-leadership
D	2000-2002	Centered on cost efficiency and customer demand;	Centrality↑	Growing global market;	/
	2003-	Explored to develop high-end and differentiated products;	Complexity↑	Anti-dumping investigation, and the trend of energy-saving;	DE: Identify new developing field

Notes: DE = Destruction of original cognitive structure; CI = Cognitive Inertia

Table VI.
The changes of
cognitive structural
attributes of case
firms

CMS
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chairman in 2001 for firm B considerably improves the complexity of managerial cognitive structure.
 “The new chairman, is well-educated compared with our founder, and he has a much broader horizon, which is totally different.”[Interview with the manager of firm B]
 Thus, based on the above reasoning, we offer the following proposition:

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P1. The incremental changes in both external and internal environment firms embedded in will enhance the complexity of their cognitive structures.

4.1.2 Performance feedback. Cognition literature suggests that past performance provides feedback for firms classifying the strategic actions as successes or failures (Weick, 1995). It offers a way to better understand why some firms respond differently than others when faced with evidence of prior errors (Hambrick and Mason, 1984). When performance falls farther below aspiration levels, firms are faced with a greater necessity to undertake strategic change for mitigating performance shortfalls (Wangrow *et al.*, 2019). Most of the work on performance feedback largely focused on contextual and firm-level influences, strategic choice patterns, and only a few of them considered its influence on decision makers (Chen *et al.*, 2015). Based on this consideration, Nadkarni and Narayanan (2007) proposed the thoughts that this information will trigger changes in the existing managerial cognition, implying the performance/strategic action-cognitive structure relationship. From our case study, the slowdown in growing rates of firm A pushed their decision makers to change their thinking from centralizing on “product quality” to simultaneously considering quality and the scale of production. Similarly, the positive feedback of the domestic market exploration encouraged firm D to pay more attention and resource in domestic market. Both of them suggest that how the original cognitive structure is either changed or retained through a process of comparison with the aspiration level. Specifically, when the performance feedback falls below their aspiration level, it establishes the stimuli for driving the changes in cognitive structure; otherwise, the original cognitive structure is reinforced with the positive performance feedback. The quotations are shown as follows:

We find that our growing rates slowed, so the current position will meet the ceiling in the next few years. Last year, we started to change our thinking, for breaking through the ceiling. [Interview with founder of firm A]

Around the year 2006, sales in domestic market only occupied less than 10 per cent. Then we invested a lot resources for exploring domestic market, the results got better year by year,

	Associated first-order concepts	Representative quotations
Table VII. Representative quotations of changes in institutional environment	Environmental protection policy	“From 2005, pressure from environmental protection became obviously, as the environmental protection policies in China turn to be much stricter.”(D)
	Tariff-related policy	“After Trump getting the position of leadership, the increasing tariffs and other barriers to trade, lead to the situation of export difficulty.” (A)
	Antitrust policy	“During 2000 to 2001, USA and European Unions adopted the actions of antitrust.”(C)
	Safety supervision policy	“Apart from environmental protection, requirements for the safety production were also reinforced, calling for safety supervision for the whole production process.” (C)

changing the importance of our domestic market. [Interview with the marketing manager of firm D]

These considerations led us to propose the following:

- P2. The comparisons between performance feedback and the aspiration level of organization will change the structural attributes of managerial cognition.

4.2 Strategy formulation process

Incremental changes often arise from small changes in the technological trajectory (Dosi, 1982; Green *et al.*, 1995), existing customers' unmet needs (Benner and Tushman, 2002) and the potential of an established design with "relatively minor changes" (Henderson and Clark, 1990, p. 9). Based on our coding process, the incremental changes faced by the four case firms could be concluded as changes in customer preferences, competitive dynamics, institutional development and macroeconomic development (Figure 1). Then, at the stage of noticing these incremental changes, though they destruct the original cognitive structure in most cases, cognitive inertia happened during their developing processes.

4.2.1 *Environmental scanning.* The sense-making process is affected by the specific nature of changes (Khan, 2018), which are different from decision-makers' previous experience. Therefore, they start to make sense of what is going on with the existed cognitive structure or with the adaptive cognitive structure after the breaking down of existed one (Balogun and Johnson, 2005). As cognitive structures are developed based on the historical environment, it is difficult for top managers to adapt their cognitive structures to the changing environment, which may result in poor organizational performance (Tripsas and Gavetti, 2000).

Researchers have reported that centralized cognitive structure may lead to "*cognitive inertia*" as focal constructs with deep historical roots are difficult to discard (Carley and Palmquist, 1992). When faced with environmental change, a simple cognitive structure may be associated with failure to recognize and interpret external changes (Kiesler and Sproull, 1982). For example, firm A once experienced a period of time only pursuing "disruptive innovation" in product development. Even though the market was changing in customer preferences, they still used the original cognitive structure to scan the environment and trapped into "cognitive inertia" aiming to lead the trend of customer demand.

At that time, we focused on "disruptive innovation" in developing products, and earned the reputation in those years. But, we ignored what the customers really need. Then we encountered the bottleneck for the limited customers. [Interview with CEO of firm A]

Although top managers are inclined to use their existing cognitive structure to understand the environment, some changes are difficult to ignore, which stimulates the need to reconsider and revise their understanding towards current situation (Shepherd *et al.*, 2017). Therefore, after noticing the environmental change, top managers begin to question his or her understanding on how the environment and his or her organization are linked. Different from cognitive inertia, *the effectiveness of cognitive structure is destructed* in this case, and top managers articulate a new or different interpretive cognitive structure to address problems or challenge (Rerup and Feldman, 2011).

The higher complexity of cognitive structure, especially the degree of differentiation capturing the number of constructs in a cognitive structure, enables top managers to notice more environmental stimuli (Walsh, 1995). The new chairman of firm B with a broader horizon better grasp the incremental changes in domestic market after China joined WTO;

and firm C, which held the belief of “Everyone has to be the information source,” developed the different cognitive structure after noticing the changes in institutional environment. Thus, top managers with more complex cognitive structures are better able to notice the incremental environmental change (Kiss and Barr, 2015) and realize the issue that the effectiveness of the original cognitive structure cannot meet the firm development in the current situation. Their representative quotations are as follows:

The new chairman is better educated than our founder, and has a broader horizon. He realized that, the industry of automobile would become the mainstream and drove the large market space of automobile gear, especially after China joining WTO. Based on this judgement, our firm expanded the business from motorcycle gears to the field of automobile. [Interview with the manager of firm B]

Before the publishing of antitrust policy by Western countries, our output was relatively low and the cost of production was high since our technology was not advanced. Then after that, the price was declining and many competitors dropped out. We shift the focus to pursue cost-leadership for expanding the market share. [Interview with deputy chairman of firm C]

We summarize the cognitive changes and the changes in their cognitive structural attributes along different developing stages of case firms for comparison (Table V). Thus, our discussion in this section leads us to propose the following propositions:

- P3a.* The likelihood of cognitive inertia of noticing incremental changes is higher when top managers’ cognitive structures are more centralized.
- P3b.* The likelihood of destructing the effectiveness of the original cognitive structure after noticing incremental changes is higher when top managers’ cognitive structures are more complex.

4.2.2 Organizational adaptation. The level of centrality in cognitive structure promotes path dependent sense-making, in which decision-makers attempt to fit new stimuli into their existing mindsets (Kiesler and Sproull, 1982). Hence, firm with the highly centralized cognitive structure tends to filter new information with the original cognitive structure for cognitive inertia. Incremental changes are usually reflected in relatively minor changes to the existing product, like small changes of technological trajectory (Dosi, 1982), or existing customers’ unmet needs (Benner and Tushman, 2002). Under such context, decision makers could gain advantages through exploiting existed knowledge base by repeated interpretation and use (March, 1991). In the first stage of firm D, its cognitive structure centered on “cost efficiency” and “customer demand” when the market size was growing. Therefore, firm D focused on tried-and-true strategies and developing detailed and sophisticated interpretations of “cost efficiency” and “customer demand” over time. Guided by such a mindset, firm D provided low-tech peripheral products following the demand of customers, and the customers could complete one-stop sourcing in firm D. It helps firm D to keep customer retention by making sense of new situations into the context of few but deeply held detailed and sophisticated construct in their mindsets. Only for two years, its market share achieved No.1 in the domestic market for the hand-operated carrier. Similarly, as the factory plant of firm A in their early stage was rented from others, they initially only centered on enlarging production capacity for building their own plant. When their global market kept growing, firm A developed a narrow set of adaptations such as acquiring second-hand equipment, process innovation and establishing the routine of ledger for mass production. The number of employees in firm A has increased from 3 in the year 1994 to

around 200 in the year 2001. The above consideration leads us to propose the following proposition:

- P4. The centrality of cognitive structure will promote the efficiency of tried-and-true organizational adaptation when meeting incremental changes.

Then, as discussed in the last section, when the environmental change results in negative performance feedback, decision makers will destruct the original cognitive structure and reconstruct the new one for improving firm performance. Furthermore, the reconstruction of cognitive structure is an iterative process between managerial cognition, environment and strategic action until the performance feedback turn to be positive. Therefore, the adaptive sensemaking process could be coded as two main streams: “*trial-and-error learning*” and “*cognitive reconstruction*”.

“*Trial-and-error learning*” is a process occurs when an organization finds that it has not met its aspiration levels, then top managers adjust their behaviors in response to negative organizational outcomes but persist in their behaviors when the outcomes are positive (Bingham and Davis, 2012). The continuous trial-and-error learning is likely to be inefficient in slow-changed context. As competitive advantage is sustainable in such a context, frequent changes in resource deployment may destruct a firm’s established competitive advantages (Ferrier, 2001). However, the stable and persistent pattern of resource deployment may lock firm resources into outdated in the changing environment (Nadkarni and Narayanan, 2007). Top managers who engage in trial-and-error learning attempt to form their strategies incrementally based on the consequences of their actions. When firm A met the challenges of firm growth, they selected the routine of developing disruptive innovation to solve it. However, based on the performance feedback, the routine could not solve the challenges, then firm A revised and tried out the new routine of developing effective and customer-centric innovation, which was shown to be helpful for the sustainable firm growth. Furthermore, firm C kept comparing themselves to the benchmark enterprises to identify the gaps between them in both product and process development, which showed the directions for them in trial-and-error learning. Thus, when firms resolve problems by trial-and-error learning, the new actions they take to do might not be consistent with their existed cognitive structure. As a result, questions about the cognitive structure may emerge, and tension will arise between solving specific problems and enacting the adaptive cognitive structure which makes sense for firms (Rerup and Feldman, 2011). Representative quotations are shown as follows:

For getting firm growth, we emphasized on continuous innovation, especially pursuing disruptive innovation. But the results showed that a lot resources were wasted. As the market size was limited, our firms encountered the bottleneck. Then we realized that we cannot develop products aimlessly for disruptive innovation, but need to develop effective and customer-centric innovation. [Interview with the founder of firm A]

Our chairman usually mentions that we want to be the No.1 in the world. So we keep comparing with the benchmark enterprises. Through continuous discussion and market survey, we keep trying to realize new breakthroughs for improving the product and process. [Interview with R and D manager of firm C]

The organization continues the recursive process of strategic actions and abstract cognitive structure (Balogun and Johnson, 2005) until it finds a solution successful enough to replace the original one, i.e. “*cognitive reconstruction*” in our coding. Specifically, firm A revised the cognitive structure by adding the aim of gaining sustainable growth to their core value; both

firm B and D adapted their vision for gaining high value-added; and firm C, for the development of product line, concluded the effective rule of achieving synergy between new product and existed product family in market channel, raw material or technology. The destruction of cognitive structure effectiveness, trial-and-error learning and reconstruction of cognitive structure could be concluded as “cognitive flexibility,” which is the ability to match the type of cognitive processing with the type of problem at hand (Laureiro-Martinez and Brusoni, 2018).

These considerations lead us to propose the following proposition:

P5. After the destruction of cognitive structure effectiveness, firms will start the recursive process of trial-and-error learning and strategic actions till the reconstruction of the cognitive structure.

We summarize the integrated organizational adaptation model in Figure 5, presenting the interaction between cognitive structure (centrality/complexity) and the strategy formulation process when organizations meet incremental changes. The main thrust of our argument is that the cognitive reconstruction process in incremental changes is distinct from those in radical changes by only emphasizing on the importance of cognitive complexity. The complexity of cognitive structure could help organization to develop cognitive flexibility, which means matching the type of cognitive processing with the type of problem at hand. Through the trial-and-error learning and the reconstruction of cognitive structure, organizational actions based on the new cognitive structure will help organizations develop relevant adaptations. Furthermore, the single-mind supported by cognitive centrality could promote the efficiency of tried-and-true organizational adaptations to incremental changes when the positive performance feedback was well-received.

5. Discussion

Our main objective is to understand the interaction between cognitive structure and strategy formulation process when firms adapt to incremental changes. Understanding this integrated process provides important theoretical and practical contributions.

5.1 Theory contribution

This study confirms that managerial cognition play a very important role when firms meet incremental changes (Chakravarthy, 1982; Kiesler and Sproull, 1982), and the model proposed here offers four primary contributions to the cognition and strategy literature.

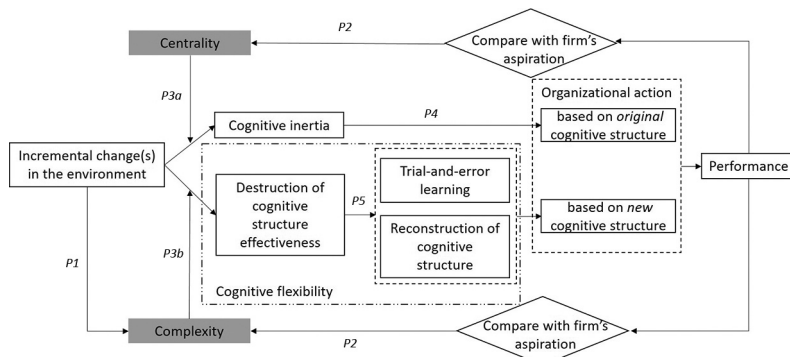


Figure 5.
The integrated model
of strategy
formulation process

First, this paper complements the traditional BTOF from the view of managerial cognition, with a deeper understanding of the micro-foundations of organizational adaptations. BTOF has worked on examining firms' behavior as a response to performance feedback (Cyert and March, 1963; Argote and Greve, 2007) and concentrating on problemistic threat-based search. Our study provides insight into the environmental scanning and the adaptive sense-making process for seizing the opportunities from incremental changes, which further confirms that search can clearly be stimulated by perceived opportunity.

Second, from an integrated view, our study proposes the model explaining the interaction mechanisms between cognitive structure and strategy formulation process. Because cognitive structure is a distinct view from strategy formulation process in cognition studies, the two perspectives have mainly been investigated independently (Narayanan *et al.*, 2011). However, this segregation has precluded greater understanding on the role of cognitive structure for how organizations adapt to changing environment (Helfat and Peteraf, 2015). By adopting the integrated view, we go further compared with existed studies such as Shepherd *et al.* (2017), which only consider the role of cognitive structure to strategy formulation process, and Labianca *et al.* (2000)'s work of constructing the linear process. Our model is able to present how the different cognitive structures affect the strategy formulation process when firms are located in incremental changes, and also how the cognitive structures are influenced by strategic action and performance feedback, both of which are outcomes of strategy formulation.

Third, environmental changes often give rise to potential opportunities (Eckhardt and Shane, 2003), and researchers have developed a series of theoretical or empirical studies for discussing the importance of managerial cognition under the changing environment. Most of them are focused on radical technological changes, thus emphasizing the changes in managerial cognition is requested for firms that did not have prior related competence in the new area (Kaplan and Tripsas, 2008). However, the incremental change could be cumulatively important (Abernathy and Utterback, 1978; Levitt and March, 1988) and under some circumstances it could also be quite risky (McKendrick and Wade, 2010). We get a deeper understanding on how the incremental change is noticed and drives further organizational adaptations by extending the existed literature to the context of incremental change. Specifically, the original cognitive structures may be appropriate to incremental changes if the performance feedback is positive rather than unlearning the existed one directly. Furthermore, different from viewing the centrality of cognitive structure as precluding organizations from absorbing new knowledge and experimenting with new alternatives (Nadkarni and Narayanan, 2007), it will promote the efficiency for developing tried-and-true adaptations to incremental changes.

Finally, most studies on managerial cognition hold the view that managers make strategic decisions based on selective interpretations of their organizational context through cognitive structure (Dutton and Jackson, 1987). As the cognitive approach allows decision makers to have incomplete, inaccurate mental models, the outcomes of strategic actions are usually inconsistent with their expectation. However, the answer for how do decision makers in response to such inconsistency might be rather convoluted. Menon (2018) stated that a deeper understanding of the determinants when and how the decision makers resolve the inconsistency is a very important issue for studying the evolution of strategic interactions. Our research shows the mechanisms of trial-and error learning during the adjustments, which is the recursive process between managerial cognition, environment and strategic action, and provides some insights about how to develop an adaptive cognitive structure in incremental changes.

5.2 Practical implications

Change is a central theme in all types of organizations. Taking hidden champions in China as cases, the findings of this paper give managers some lessons in managing incremental changes, especially for firms operated in emerging economies. By focusing on the integrated organizational adaptation model, our study suggests that when firms are faced with incremental changes, cognitive reconstruction for responding successfully to the changing environment may not be necessary, i.e. because, unlike facing radical changes, the trial-and-error knowledge from past experiences is still important to rely on in incremental changes when the performance feedback is positive through organizational adaptations based on original cognitive structure. Therefore, the simple mind could promote manufacturers in niche markets to develop deeply rooted strategic actions, and the complex cognitive structure allows firms to notice and response quickly to more stimuli, which, in turn, increases the adaptability to incremental changes. Our findings also suggest the ways in which managers could proactively reconstruct their cognitive structure through continuously trial-and-error learning. However, given the roles of centrality and complexity in promoting organizational adaptations, managers are suggested to consider the balance in attention allocation for the limited cognitive capability. It provides managers with the direction of adjusting their managerial cognition for better maximizing the roles of complexity and centrality by considering the current context of developing stage or competitive intensity.

5.3 Limitations and further research

This research has certain limitations. First, it should be mentioned that there are many elements that could affect managerial cognition from multi levels (Csaszar and Levinthal, 2016), including individual, group and environmental influences (Narayanan *et al.*, 2011). Therefore, future research could try to explain the variance in the development of cognitive structure by offering insights on its determinants.

Furthermore, a major challenge in conducting researches on managerial cognition is the measurement issue (Hoskisson *et al.*, 2017; Kaplan, 2011). In our research, the structural attributes of managerial cognition were captured mainly based on the transcription of in-depth interviews, but interviews may suffer from problems of reliability and replicability (Surroca *et al.*, 2016). Thus, further researches could be designed by adopting mixed-methods in the measurements. In particular, researchers may use qualitative approaches that precede quantitative methods to provide richer and more accurate insight before developing measures for large-scale analysis.

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