

CHINESE PROVINCIAL GOVERNMENTS' MANAGERIAL TONE OF PUBLIC ENTREPRENEURSHIP AND REGIONAL KNOWLEDGE EVOLUTION

Hua GENG[†]

School of Language, Literature, and Law, Xi'an University of Architecture and Technology, Xi'an, China, genghua@xauat.edu.cn

Royal School of Business and Law, University of East London, London, UK, u2132639@uel.ac.uk

Qingan HUANG[‡]

Royal School of Business and Law, University of East London, London, UK, q.huang@uel.ac.uk

International Business School, Guangdong University of Finance & Economics, Guangzhou, China, Qingan.Huang@outlook.com

Vassilis FOUSKAS

Royal School of Business and Law, University of East London, London, UK, v.fouskas@uel.ac.uk

Benzhao YANG*

Yangtze River Delta Institute of NPU, Northwestern Polytechnical University, Xi'an, China
*yangbenzhao@nwpu.edu.cn

Abstract: This paper certifies influences of provincial governments' managerial tone on regional knowledge evolution through fixed effect regression. Based on public entrepreneurship and upper echelon theory, the research forms a panel data combining strongly-balanced 496 observations of 31 Chinese mainland provinces' managerial tone in government work reports (GWRs) with their knowledge evolution indexes. Through fixed effect regression, the quantitative study investigates if, how, and to what extent the tonality constructs in provincial governments' managerial communication promote or hinder knowledge evolution. It is unique to interweave linguistic features with entrepreneurial research and interpret the framework of textual analysis and knowledge evolution from the provincial and longitudinal view. Furthermore, the study brings policy implications to regional governance and embarks on provincial governments' considerate use managerial discourse to foster innovation and enhance the applicability of managerial tone in public entrepreneurship.

Keywords: Managerial tone, public entrepreneurship, provincial governments, regional knowledge evolution

Track: Entrepreneurship

Word count: 6984 words

Introduction

The present times is deemed as an age of innovation and entrepreneurship with entrepreneurship firing the imagination of everyone (Mehmood *et al.*, 2019) and innovation as a key driver of economic growth for countries at various stages of development (Aghion, Akcigit and Howitt, 2015; Akcigit, 2017). Developed countries create high-value products relying on cutting-edge innovation, while developing countries endeavor to shift from imitation to innovation to escape from the middle-income trap to high-income economies (Wei, Xie and Zhang, 2017; Zilibotti, 2017). The academic field also sees an emerging trend on entrepreneurship worldwide (Welter and Lasch, 2008; Bruton *et al.*, 2013).

Rooted in public entrepreneurship, this research attempts to investigate the link between Chinese provincial governments' managerial tone and the corresponding regional knowledge evolution. The unique dataset makes it feasible to explore and verify the tonality influences on knowledge creation and acquisition from 2006 to 2021 on a comprehensive textual analysis of GWRs in Chinese mainland provinces. Moreover, we are enabled to externalize the complex world of the provincial government leaders' managerial minds and its impact on provinces' knowledge performance from the lens of their tone.

Public entrepreneurship is generally defined as the use of formal and informal business practices to create innovative activities in public sector organizations or spheres of government activity (Funko, Vlačić and Dabić, 2023), which is rarely studied in Asia. In Chinese context, along with the first proposal of "mass entrepreneurship and innovation initiative" by Premier Li in 2014 and the subsequent issuance of policies, measures and institutional designs (Kedi, 2025), entrepreneurship has become one of the key terms for economic and social development led and promoted by the government with their public entrepreneurial administrators and policymakers. Going deeper into Chinese provinces, entrepreneurship research has its own characteristics in each region (Su, Zhai and Landström, 2015) according to the differences of business, historical, social, spatial and institutional context (Trettin and Welter, 2011; Zahra and Wright, 2011) documented in various literature. To overcome the complex challenges from public services and society, Chinese government leaders, in particular the local state officials play dual roles of public servants with decision-making autonomy in the economic society and business leaders and entrepreneurs demonstrating greater interest in introducing, developing market instruments and engaging in state entrepreneurialism, the market-like entrepreneurial activities (Wu, 2018) driven by the fiscal responsibility of local governments from the enterprising dimension. With region as a geographic agglomeration and an area of localized learning is agreed upon by various other authors (Asheim *et al.*, 2003; Cook and Memedovic, 2003; Chen and Guan, 2010; Avendano, Tani and Tolin, 2024), the researchers identify a new form of governmental influence through political statements in provincial GWRs in a systematic comparison over 16 years at all Chinese mainland provinces and evaluate the political consequences on knowledge evolution to verify the influential appeals at provincial level.

Therefore, the research and analysis on Chinese provincial government's tone

influence on knowledge evolution from the angle public entrepreneurship is vital and meaningful for academic research on entrepreneurship at other regional levels or in other countries. It is especially the case for Chinese government in the “soft” transiting process to free market through casting influence in communicative tonalities from a “closed-loop” view of decision making in a “high-level” cognitive science perspective (Gonzalez, 2014; Galavan, Sund and Hodgkinson, 2017). It also rises the governors’ awareness of the proper expressions in public speeches.

Theories and Hypotheses

Public Entrepreneurship and Upper Echelon Theory

Among the substantive shift in the focus, content and methods of entrepreneurship research, Zahra and Wright, (2011) highlighted how to strengthen the link between entrepreneurship research and public policy as a next act. In Mazzucato’s book *The Entrepreneurial State* (Mazzucato, 2015), governments and entrepreneurship were further correlated according to the statement that government is not merely a bureaucratic machine hampering innovation, instead, the government also intervene through enactments of policies and other more “softer” ways. To emulate the model of success, perception of the government role of a bureaucratic machine should be changed to a new understanding: the participant and lead risk taker in terms of innovation and technological development (Mazzucato, 2011). Li’s research of China Inc. (2022a, 2022b) further confirmed Chinese government’s involvement in business and entrepreneurship through transforming China into a giant corporation, with the governments as the manager, enjoying the agility of a firm and the vast resources of a state.

Introduced and developed by Hambrick and Mason (1984), Upper echelon theory (UET) claims that organizations are a reflection of their top managers as the traits of the top management team (TMT) are determinants of a firm's strategic choices and thereby of its organizational performance (Crossland *et al.*, 2014; Yohannes and Ayako, 2016; Georgakakis, Greve and Ruigrok, 2017), which also inspires the overview of the growing importance of the power of words as a means to look into executives’ minds (Cho *et al.*, 2014). In Nielsen’s (2010) view, ‘Upper Echelons research is increasingly multidisciplinary in nature’ and research into it has entered diverse research fields inside and outside the academic discipline of management (Wren and Bedeian, 2023) and led to consistent streams of research (Abatecola and Cristofaro, 2018; Dhaouadi, 2018) for the sake of using TMT characteristics as a good proxy for cognition due to the difficulties of access and measurement of the cognitive variables (Díaz-Fernández, González- Rodríguez and Simonetti, 2020).

Based on the increasing attention paid on governments’ involvement in entrepreneurship and upper echelon, we endeavor to carry out interdisciplinary research to explore the influence of governments’ communicative tone on perspectives of knowledge creation and acquisition at a provincial level through textual analysis of GWRs, which is rarely studied before. Previous tone analysis of GWRs mainly focus on central government’s attitude, yet the large territory in China makes competition and economic growth with regional features inevitable (Herrmann-Pillath and Feng, 2004; Bian, Wu and Bai, 2019), thus this research turns our vision to provinces and tries to

measure the influences of regional governments' tone on knowledge evolution based on the following hypotheses.

Hypotheses of Concentration

As the contemporary practice of Engels' "theory of historical resultant force", mobilizing resources for major events is both the summarization of China's experiences of the achievements since the founding of new China and a means of realizing the modernization of national governance (Su, 2020). China's modernization steps with the well-defined road map have been and will continue to be solid only under the leadership of the Communist Party of China (CPC) in three layers of pioneer in exploration, the central pillar to unite all, and the ultimate guarantee as a safeguard in crisis and challenges (Zhang and Fan, 2024), in which process the government-led macroeconomic regulation and control continues to improve. Having its unique feature and great strength of socialism with Chinese characteristics, the CPC maintains a strong grip on executive and legislative power (CPC Leader Group, 2025) and highlights concentration to realize common prosperity in economic environment (Liu *et al.*, 2024). Within this context, many scholars and researchers deem power concentration for major undertakings as a common feature of governments' reactions, seeking to maximize the effectiveness of their decisions (Malandrino and Demichelis, 2020; Bolleyer and Salát, 2021). China's adherence to peaceful development (Zhang and Feng, 2019) makes concentration on major tasks the optimized selection for developing countries to achieve the leapfrog development by pooling the resources on account of the bare facts of large population, weak economic foundation, limited resources, and imbalance among urban-rural and regional development. The dominant advantage of concentrating strength has its unique function in promoting the development of the cause of the Party and the country and realizing China's Effective Governance (National Academy of Governance, 2020). In the recently released State balance sheets of China, it is still emphasized to concentrate strength for major undertakings to enhance the financial guarantee of major national strategies, with special focus on scientific and technological innovation as well as the development of manufacturing industries (Sun, 2024). From a broader-history perspective, pooling of resources is also considered as a vital key (Liu, 2024) of CPC to lead the people in the 100 years of struggle and varied historical periods, which has been an abiding principle, philosophy and strategy to carry out a series of major moves. To some extent, concentration for major tasks is not only an effective way to promote economic development, but also a top-down institutional structure widely accepted by the public.

However, the use of resources is mainly conditioned by the multilevel structure of the country from a general view. (Parrado and Galli, 2021) without taking concrete regional conditions into consideration. Most studies of authoritarian legislatures analyze functions and operations of the national congresses (Schuler, 2018; Noble, 2020) ignoring the local congresses' illustrative case of party control of legislatures. As a matter of fact, the local congresses are more vibrant and play a vital role in local politics (Manion, 2015) and polycentric urban development has been considered a sustainable planning strategy for policymakers and practitioners in both developed and developing countries (Meijers and Burger, 2010; Huang *et al.*, 2017). This study

transfers the highly emphasized construct of concentration by central government to a lower provincial level, and tries to find out whether the influential concept still works effectively on regional knowledge evolution.

Concentration is demonstrated in a reflective way with a combination of the three variables from textual analysis: tenacity, leveling terms, and centrality. Tenacity connotes confidence and totality with uses of the verb to be, three definitive verb forms and their variants, as well as all associated contraction's and determines the actors' persistence, presented in how long the simulations last and how intensive the actors cooperate (El-Gemayel, Sibertin-Blanc and Chapron, 2011); leveling terms accounts for the words used to ignore individual differences and to build a sense of completeness and assurance, including totalizing terms, permanence and resolute adjectives; and centrality refers to the descriptions of institutional regularities and/or substantive agreement on core values. State entrepreneurialism (Wu, 2018) combines two features in urban governance studies in China: planning centrality and market instruments, however, concentration is mainly studied at national level. For local governments which are at the receiving end of the global financial market, systemic financial shortage, and local demand (Birch and Siemiatycki, 2016; Peck, 2017), provincial governments' emphasis on concentration is supposed to have a negative effect on evolution and update of regional knowledge.

The arguments above lead to our first hypotheses on concentration, taking it as a negative force in regional knowledge creation and knowledge acquisition.

Hypothesis 1a: Chinese provincial governments' emphasis on concentration negatively affects the regional knowledge creation.

Hypothesis 1b: Chinese provincial governments' emphasis on concentration negatively affects the regional knowledge acquisition.

Hypotheses of Realism

Another core ideas of CPC about socialism with Chinese characteristics, seeking truth from facts is the theoretical basis of Marxism-Leninism and the soul and essence of the theoretical achievements of Sinicization of Marxism (Ma, 2020). The adage has a long history in Chinese culture and has been repeatedly stressed by different generations of leaders. Formally raised in the late 1970s (China.org.cn, 2021), it is taken as one of the bases of Deng Xiaoping theory articulated above all in a key speech delivered at the beginning of the Reform and Opening-Up (Boer, 2021). It is not only used to mobilize the country to look for means of development in economy and policy, but also popular in different aspects of social life in a fact-based manner. The main ideological line of seeking truth from the facts is to proceed from reality, integrate theory with practice, and insist that practice is the only standard to test truth (Arena, 2015).

This Chinese political idea metaphysically corresponds to the doctrine in the theory of meaning and philosophy of language concerning the nature of truth and its role in accounts of linguistic understanding (Forster, 2015). In entrepreneurial culture, imagination needs to be fired by creativity and uniqueness etc. However, from the philosophical perspective, realism lays emphasis on the existence of macroscopic objects, the fact of their existence and corresponding properties (Miller, 2024).

Therefore, the construct realism is adopted in the research to display the facts of provincial condition from the governors' view. Since there are substantial metaphysical issues about the nature of facts, objects, and properties and the relationships between them (Lowe, 2002), familiarity and complexity are employed as the reflective factors of realism in GWRs, in which familiarity refers to the operation words used as the most common words in English language, while complexity is interpreted as a simple measure of the average number of characters-per-word in a given input file making a text's ideas abstract and its implications unclear (Digitext Inc., 2013). They highlight the focuses on the uninspiring day-to-day ordinary and ambiguous abstractness, thus the two features of reality presented in GWRs cast a gloom over the regional development and lead us to propose that:

Hypothesis 2a: Chinese provincial governments' attention paid to realism brings about negative effect on regional knowledge creation.

Hypothesis 2b: Chinese provincial governments' attention paid to realism brings about negative effect on regional knowledge acquisition.

Hypotheses of Positive Emotion

Other than the objective political thoughts discussed above, studies on subjective attitude implied in governments' expressions are very limited. Within a country of market economic system, the major function of government is to create an environment for technology innovation instead of direct intervention of enterprise innovation (Research Group on Development and Strategy of Science and Technology of China, 2003). Mazzucato (2015) ever stated in *The Entrepreneurial State* that the government is not merely a bureaucratic machine hampering innovation, but also subjectively acts as leading risk taker investing for innovation and supports the development of a business strategy to reduce potential losses and exploit windows for opportunity (Beasley, Pagach and Warr, 2008; Hoyt and Liebenberg, 2011). With the governments' deep involvement as both service providers and players, governments' hidden emotions in their communication also draw our attention and are worthy to be explored. Regarded as mental states aroused by cognitive evaluations of events or thoughts following a phenomenological perspective, emotions are usually connected to physiological or physical processes and result in specific actions (Casaló, Flavián and Ibáñez-Sánchez, 2021). Positive attitude, as an important cognitive component of optimism (Malinowska-Cieřlik *et al.*, 2019), has been found to enhance performance (Hattie and Timperley, 2007; Arbel, Murphy and Donchin, 2014). The effect of positive cognitive emotion has been broadly studied and verified in diversified aspects and fields. Tracy *et al.* ((Tracy *et al.*, 2014) have taken the positively valenced and pleasurable emotion of "pride" as the single most important emotion underpinning the attainment and maintenance of success, power, and status; in ecological settings, the less individuals felt positive emotions, the more they tended to enhance their use of positive strategies, which in turn resulted in subsequent higher levels of positive emotions (Colombo *et al.*, 2021); positive emotions are also playing the role of widening the attentional scope, repertoire of people's possible actions, and creating openness to new experiences (Kok and Fredrickson, 2013) based on the broaden-and-build theory of positive emotions (Fredrickson, 2003); emphasizing the pursuit of what is good, virtuous, and possible

and the focus placed on strengths (Kern and Wehmeyer, 2021). Positive psychology perspective has been applied across a growing number of studies within the cross-disciplinary contexts, the proposition emphasizing the positive effect and phenomena has always been popular (Rusk and Waters, 2013). Yet the initial underlying bias of the field was to emphasize the individual person and human agency, with only secondary focus on broader social and contextual aspects that impact upon human experience (Kern *et al.*, 2020). The textual analysis of satisfaction in this study measures terms associated with positive affective states (cheerful, passionate, happiness), with moments of undiminished joy (thanks, smile, welcome) and pleasurable diversion (excited, fun, lucky), with moments of triumph (celebrating, pride, auspicious) and words of nurturance. (Digitext Inc., 2013) Therefore, our research extends the effect of positive cognition from the frequently seen individual angle to a broader regional and organizational level because the leaders are treated as the carriers of frame-breaking understandings and integrated collective intelligence (Spiller *et al.*, 2020) and the hosts to promote shared learning, effective group decision making, visioning and goal setting and reflection etc. (Wheatley and Frieze, 2011). Chinese government's emphasis on positive emotion represented by the factor of satisfaction is taken as the key influencing factor exerting a positive effect on knowledge creation and acquisition, and the research test the following hypotheses:

Hypothesis 3a: Chinese provincial governments' emphasis on positive emotion boosts regional knowledge creation.

Hypothesis 3b: Chinese provincial governments' emphasis on positive emotion boosts regional knowledge acquisition.

Methodology

Key constructs and data collection

In accordance with the hypotheses above, the research includes the key constructs of "Concentration" (measured through the variables of "Tenacity", "Leveling terms", and "Centrality"), "Realism" (measured through the variable of "Familiarity" and "Complexity"), "Positive emotion" (reflected by the variables of "Satisfaction" as independent variables, which demonstrate provincial governments' tonality, value and preference are extracted from GWRs of 31 provinces using the software of DICTION.

The dependent variables extracted from the Annual Report of Regional Innovation Capability of China mainly reflect the condition of regional knowledge evolution in different provinces from two dimensions of knowledge creation and knowledge acquisition. To be more specific, knowledge creation refers to the ability of creating new knowledge continuously as the foundation of technology innovation, which is applied in industry and life to boost human ingenuity. It can be subdivided into basic indexes of funds on R&D, patents granted and domestic scientific papers published for further measurement, among which the newly issued patents and knowledge creation in papers and dissertations are the important resources of innovation. Moreover, the process of knowledge innovation is also a process realized through the investment of science and technology (S&T) agencies, human resources and scientific research funds. (Research Group on Development and Strategy of Science and Technology of China, 2003). This index varies among different provinces in Chinese mainland and shows a

dynamic developing trend in the period of research. Knowledge acquisition is defined as the ability to continuously utilize any available knowledge all over the world and the ability to ensure the flow of knowledge among different innovative units in multiple forms of knowledge sharing, university industry collaboration, technology market turnover and foreign direct investment (FDI) etc., which is of vital importance for developing countries to realize rapid economic catch-up (Research Group on Development and Strategy of Science and Technology of China, 2003, 2023). The dependent variables and control variables are mainly derived from Annual Reports of Regional Innovation Capability of China sponsored by Ministry of Science and Technology of the PRC and China Statistical Yearbook compiled by NBS of China within the corresponding period, both are authoritative with high reliability.

The economic variable of “Population” and “Household disposable income per capita (HDI)” and the educational variable of “Institutions at higher education level (IHE)” play the role of control variables, which respectively reflect the economic and educational conditions of provinces and intervene the regional innovation capacity. The depend and control variables are presented with a two-year and one-year deduction respectively based on their backtracking strategy, making us trace back to the accurate data of the right year.

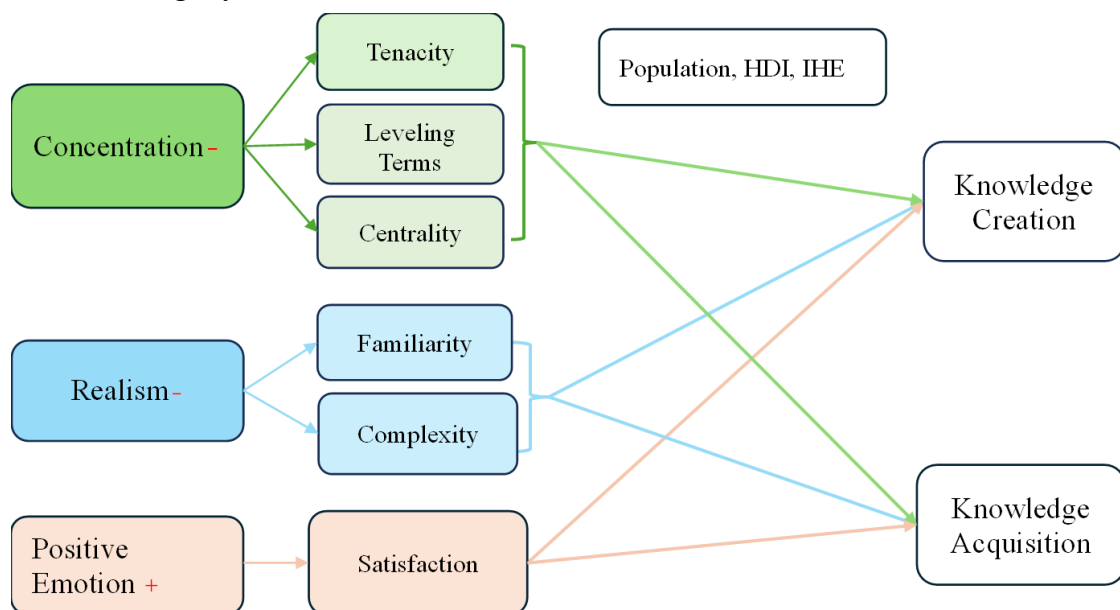


Figure 1. Key constructs and variables

Compared with the commonly used multiple-case research design (Eisenhardt and Graebner, 2007) emphasizing a replication logic, this research has built a longitudinal panel data of textual analysis of provincial GWRs, Annual Reports of Regional Innovation Capability of China and China Statistical Yearbook, covering all 31 mainland Chinese governments in 16 years from 2006 to 2021.

These GWRs are adopted as the sources of independent variables. At the beginning of each new year, governments at all levels are required to submit the report for approval on "two sessions" , i.e. People’s Congress (PC) and the Chinese People’s Political Consultative Conference (CPPCC) respectively held on an annual basis (www.gov.cn, 2013). GWRs offer a channel for the publicity of governments’ work

and policies (Wang and Yang, 2023), which are the official documents and important political discourse delivered annually in “two sessions” at the provincial level--- Provincial People’s Congress (PPC) and Provincial Committee of the Chinese People’s Political Consultative Conference (PCCPPCC). GWRs are addressed by the provincial leaders such as governors, acting governors, or chairmen of autonomous region from a timely and authoritative view to reflect the governments’ governing philosophy and denote the policies to be implemented in the year to come (Wang and Yang, 2023). Serving as a link between past and future, GWRs mainly involving a review of the government work in the previous year, the major aims and overall requirements based on the judgement of the current situation, as well as an outlook for the provinces’ plan and tasks in the new year (He, 2023). The selected provincial GWRs of all the 31 mainland provinces, municipalities under central government, and autonomous regions of China range from 2006 to 2021 and the total data size for analysis is text-derived words for the panel are 6,179,621 from 31 provinces which are collected for textual analysis by Diction software. Yet since the data in the reports are all generated from the previous year, the output variables are processed and calculated with a time lag of one year, which means we use all independent variables with one year forward values.

The independent data mining is carried out in two steps. As the most important policy document, the periodically released and publicly open GWRs are considered as the indications of setting out a vast range of economic and development tasks to pursue over the coming year (Huld and Zhou, 2022). In the first place, the original Chinese version of government work reports is compiled from official government websites, among which some missing years are obtained from an authoritative source of China Economic Net (en.ce.cn) so that the data are genuine and systematic. Subsequently, with a whole amount of 8,666,564 words presented by Chinese provincial governors, the researcher translated them from Chinese into English to ensure the availability and retrievability of these raw data. Then the total characters analyzed for content analysis are 43,271,698 and the text-derived words for the panel obtained are 6,179,621 in the translated English version.

To maintain the translating efficiency with relatively low cost in limited time and to avoid any personalized features brought by translators, all the task is done by machine translation. Moreover, paired sample T test is employed to validate translation accuracy. The researchers encode all the GWRs in 16 years with natural numbers and obtain 10 GWRs through simple random sampling without repetition. The selected Chinese textual material is distributed to 5 volunteer qualified translators with Test for English Majors (TEM) 8 certificates randomly for retranslation, and these human translated versions are compared with their corresponding machine translated ones with the key independent variables as the focus. According to the analysis results in table 1, the p values of all variables measured are all higher than 0.05, demonstrating that there is no significant difference statistically between two types of translation. This result convinces the researchers of the choice of the initial machine-translated version for efficiency, and makes the database more credible.

Table 1 Paired sample T test of machine and human translations

	M1±SD1	M2±SD2	<i>t</i> (df)	<i>p</i> value	Significance
Tenacity	9.28±3.19	9.29±3.30	-0.12 (9)	0.901	ns
Leveling Terms	3.94±1.25	3.92±1.18	0.42 (9)	0.685	ns
Centrality	12.50±3.56	12.48±3.56	0.64 (9)	0.537	ns
Familiarity	115.47±8.59	115.46±8.59	0.36 (9)	0.730	ns
Complexity	5.8±0.29	5.83±0.28	-1.60 (9)	0.144	ns
Satisfaction	3.69±1.34	3.74±1.37	-2.11 (9)	0.06	ns

Then the researchers have performed a thorough content analysis through longitudinal study of provincial data panel in 16 years, with the purpose of getting a clear understanding of governments' thoughts, values, beliefs and managerial strategies hidden behind their public communicative words in GWRs. 2006 is taken as the initial starting time because the State Council of People's Republic of China (PRC) released the National program for Long- and Medium-Term Scientific and Technological Development (2006-2020) (Xinhua News Agency, 2006). 2021 was chosen as the cut-off year for the availability of the data within the research range from the Annual Report of Regional Innovation Capability of China. Because the yearly released Annual Report of Regional Innovation Capability of China is based on the essential data of two years ago, for example, in the Annual Report of Regional Innovation Capacity of China 2023, the data base is from 2021, the latest available edition of the report during the research period is for 2023 since the report is issued at the end of the year.

Measurement of variables

In this study, a balanced short and static panel is built with all the independent variables, dependent variables and control variables involved, and any data missing will go over smoothing processing with the help of the mean value of data in the previous three years, which is a commonly seen method in data processing. We make the relative magnitudes of the variables achieved comparable over the years and ensure the comparability of variables by avoiding the discrepant interventions of social contexts and time etc. (Thompson, 2019; Attanasio, Meghir and Nix, 2020). For example, although the emphasis of "Satisfaction" remains fluctuating in the research period, the fluctuations vary in different provinces.

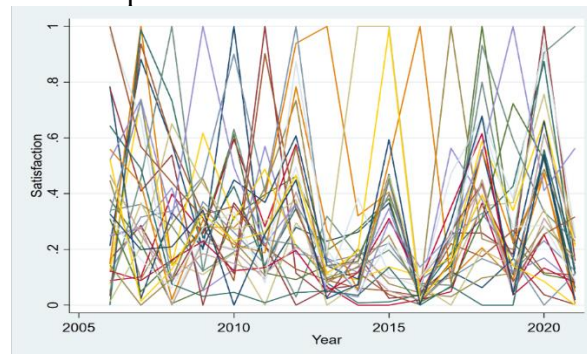


Figure 2 The Dynamic Focus on "Satisfaction" in 31 Provinces

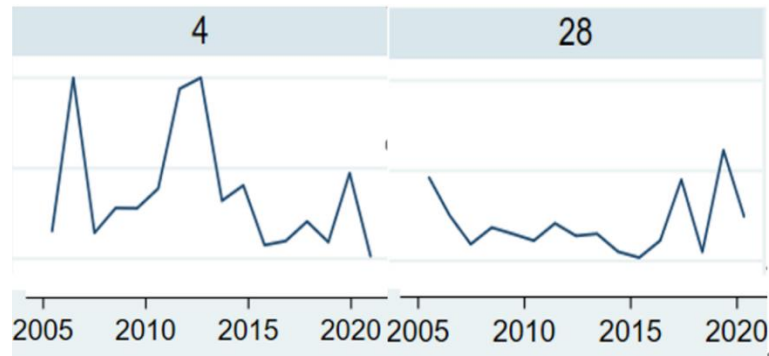
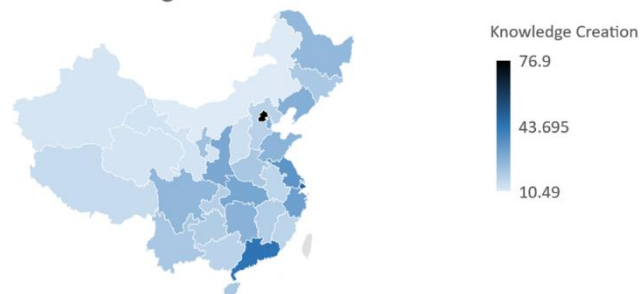


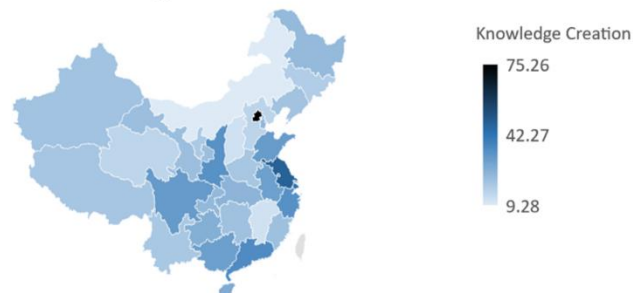
Figure 3 “Satisfaction” in Fujian and Tibet

Knowledge creation experienced ups and downs from 2006 to 2021 with the central areas and southern and eastern coastal areas playing the leading role in knowledge creation. Yet knowledge acquisition remained general downswings, which might be caused by the appeal for independent innovation by individual provinces instead of basing regional innovation on new knowledge from external sources.

Knowledge Creation in China in 2006



Knowledge Creation in China in 2014



Knowledge Creation in China in 2021

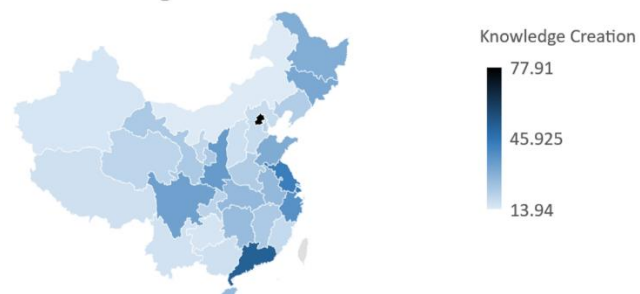


Figure 4 Knowledge creation in China 2006-2021

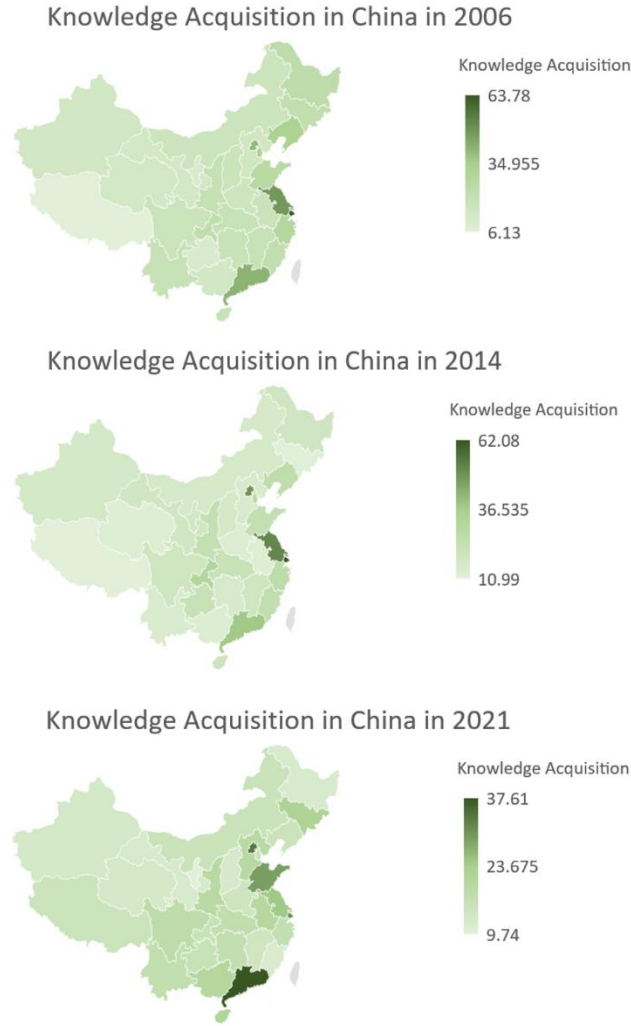


Figure 5 Knowledge acquisition in China 2006-2021

Analytical Approach of Fixed Effect Panel Regression

Then we from a choose panel regression models with fixed effects approach, given that fixed effects allow to control for the variety of possible province characteristics and management characteristics even without measuring the characteristics explicitly, as long as there is no change of those hidden characteristics over time, i.e., time invariant (Antonakis *et al.*, 2010) and the focus is mainly laid on within-group differences. On this basis, the researchers adopted the robust algorithm of individual fixed regression, which is general method enabling us to perform regression in spite of the loss caused by outlying points or heavy nose to minimized the mean square errors. Through DICTION software, we got the independent variables directly from the classification of DICTION dictionaries and variables, which are respectively: “Tenacity”, “Leveling terms”, “Centrality”, “Familiarity”, “Complexity”, “Satisfaction”, which will either be employed independently or jointly as the reflection of a key construct in the coming panel data analysis and definitions of variables and measurement listed as appendix at the back of the thesis. However, due to the great disparity of the data value in DICTION analysis results ranging from 0.04 to 107.21, which make it difficult to make the comparison with the intervention of some extremum values, we employ a common convention: the min-max normalization, often shortened as normalization, to all tonality-based variables through built-in dictionaries, i.e., variables existed in and derived by Diction software, have thereafter been normalized

to the range of [0...1], with 0 being assigned to the minimum value and 1 assigned to the maximum value per province per variable per year. With the help of the equation $x' = (x - \min(x)) / (\max(x) - \min(x))$ on the same measure every year to normalize the tonality-based variables, within which $\max(x)$ is the largest value of the very variable and $\min(x)$ represents the smallest value of that variable.

Fixed effects panel models are appropriate to investigate variables from different theoretical viewpoints (Tuggle, Schnatterly and Johnson, 2010). In addition, panel data have more degrees of freedom than the single cross-sectional units or time series data of individual dynamics because the sample provide rich information to meet the requirement of the specific model so that the problem of data multicollinearity can be reduced, which helps to eliminate estimation bias based on a large sample size (Hsiao, 2014). The fixed effects model is adopted in this research given that it allows to control for the variety of possible province characteristics even without measuring the characteristics explicitly because of the invariant features.

The analysis is made by investigating whether managerial discourse is related to regional innovative capacity. By performing a fixed panel regression of the regional innovative capacity measure on the management tone variable while controlling for other regional innovation data on stock as the foundation and starting point for future innovations. The baseline regression model takes the following equation to explain how independent variables influence the dependent variables:

$$Y_{it} = \alpha_i + X'_{it}\beta + (U_i \text{ government} + U_i \text{ province}) + \varepsilon_{it}$$

Within the equation, the modelling accounts for the effects of governments' communicative cognitions on regional innovation capacity, and the strongly balanced time-variant full data are measured in a range of 16 years. Yet those variables that do not change over time but vary across entities, which we call entity fixed effects, are eliminated due to the continuous observation and the analysis is narrowed to a with-province dimension. According to the data source of the year, we push the data a year or two years back to the exact years they should belong to and then no time lag is considered in the actual regressing process of the exactly annualized panel.

The three panels constructed in the previous part are imported into the software of Stata for fixed-effect regression separately to study the time-invariant features within each panel. As a multi-purpose statistical data analysis tool widely used in researches of various fields and disciplines such as data science, economics, business, public policy, sociology etc., the researchers adopt Stata because of its complete and integrated feature of accurate data manipulation, visualization, statistics, and automated reporting (Stata.com, 2025).

Research Results

Taking the tonality variables directly derived from DICTION into consideration, the flow of independent variables come into our sight and are normalized to the range of [0...1], including tenacity, leveling terms, centrality, familiarity, complexity, satisfaction. Among them, familiarity comes out on top with the mean value of 0.565186, which is apparent to see because even people are free to speak, they are not free of the deeply-rooted stable and uniform common senses and popular beliefs (Kulyk, 2006) generated from their familiar social tradition, culture etc. or political national particularism to ensure social stability (Wolczuk, 2000). Therefore, what constitute a

major part of their communication is the things they are familiar with, which would prison them in Information Cocoon (Peng and Liu, 2021; Sunstein, 2023). What ranks as the second and third as the mean values are complexity and centrality, with the former emphasizes the abstract and unclear ideas with the hint of annoying feeling and the later one pays attention to core values of the whole country as a national policy.

General Description of The Dataset

Table 2 Descriptive statistics of knowledge evolution

Variable	Obs	Mean	Std. dev.	Min	Max
Knowledge Creation	495	25.30539	13.1652	4.71	85.26
Knowledge Acquisition	495	22.78491	12.10384	4.54	65.91
Tenacity	496	0.397699	0.251876	0	1
Leveling Terms	496	0.341318	0.260701	0	1
Centrality	496	0.404918	0.250816	0	1
Familiarity	496	0.565186	0.245908	0	1
Complexity	496	0.497807	0.249837	0	1
Satisfaction	496	0.276744	0.250103	0	1
Population	495	4395.467	2839.641	283	12684
HDI	495	19793.56	12200.7	3804.7	78026.6
IHE	495	79.21212	39.80201	6	167

On average, the mean value of HDI per capita is 19793.56 yuan at the provincial level, with the minimum of 3804.7 and maximum of 78026.6, which is a key indicator attracting extensive attention and providing important reference for formulation of policies and improvement of people's livelihood (NBS (National Bureau of Statistics), 2025). The different values of HDI shows the wide economical gaps of human development in the sample of Chinese provinces, such as people's income level, the living standard, the purchasing power, and the well-being of the residents etc. Moreover, although the average population in province is 43,954,670, the great range of population from minimum 2,830,000 to maximum 126,840,000 in different regions indicate that some of the provinces have much higher density of population than others, which is a double-edged sword in offering rich human resources while increasing the competitive pressure. Together with the disparity of the number of institutions in higher education, they present the significant regional variations of provinces in China and lay a realistic and practical foundation for this research because the provinces driven by varied backgrounds and progressing at completely different paces should be studies separately so as to get more individualized solutions. The number of institutions of higher education is 79.21212 at an average level among provinces; however, the province with the least higher education institutions only has 6, while the province with the most has 167 universities. Since universities and other higher education institutions can provide valuable knowledge (Ritala *et al.*, 2015; Díez-Vial and Montoro-Sánchez, 2016), innovative force for knowledge transfer and economic development (Krishna, 2019), and unique human resource of talents (Razali *et al.*, 2024), the number of institutions

in higher education is treated as a symbol of the knowledge related resources in that province.

The Knowledge Evolution Models are presented in four variants, variant (1) includes the reflective variables of concentration, i.e., tenacity, leveling terms, and centrality and the control variables. Variant (2) contains the reflective variables of realism, i.e., familiarity and complexity and the control variables. Variant (3) is composed of the variable of satisfaction and the control variables. Variant (4) represents the full model, with all the independent variables and control variables included together. Control variables set the model in economic and educational contexts: Population, HDI, IHE. And their effects on knowledge evolution and knowledge acquisition are presented respectively in the following tables. The full models take all the independent variables and all the controlled variables in combination, which demonstrate the overall effects of provincial governments' cognitive tone on regional innovation capacity form a holistic view. Although the values of r^2 varied in different variants of these models, the full model variants also provide the highest r^2 , ensuring the effect of all independent variables and control variables in the models explain the dependent variables in a best way.

Table 3 Knowledge correlation

	Knowledge Creation	Knowledge Acquisition	Tenacity	Leveling Terms	Centrality	Familiarity	Complexity	Satisfaction	Population	HDI	IHE
Knowledge Creation	1										
Knowledge Acquisition		1									
Tenacity	-0,0577	-0,0194	1								
Leveling Terms	-0,0792*	-0,0786*	0,1804***	1							
Centrality	0,0284	-0,0392	-0,0693	0,0009	1						
Familiarity	0,0117	0,0183	0,0383	0,1508***	- 0,2487***	1					
Complexity	0,1113**	0,0994**	0,3085***	0,1331***	0,1154**	0,3209***	1				
Satisfaction	-0,0011	-0,0063	-0,0226	0,0522	-0,0447	0,1220***	-0,0102	1			
Population	0,2153***	0,1697***	0,0282	- 0,2047***	-0,0533	-0,0541	-0,0084	-0,0290	1		
HDI	0,5621***	0,3696***	0,0297	0,0841*	0,0662	0,0628	0,0221	-0,0761*	0,0516	1	
IHE	0,4014***	0,2959***	0,0607	- 0,1447***	-0,0391	-0,0173	0,0103	-0,0089	0,8720***	0,2837***	1

***p<0.01, **p> 0.05, *p<0.1

Table 4 Knowledge creation

	(1) Knowledge Creation	(2) Knowledge Creation	(3) Knowledge Creation	(4) Knowledge Creation
Tenacity	-1.196* (-1.734)			-1.653** (-2.539)
Leveling Terms	-1.425** (-2.646)			-1.436** (-2.579)
Centrality	-0.00908 (-0.012)			-0.157 (-0.213)
Population	-0.00126 (-0.800)	-0.00139 (-0.925)	-0.00122 (-0.799)	-0.00138 (-0.907)
HDI	0.000114** (2.084)	0.000108** (2.060)	0.000111** (2.131)	0.000113** (2.161)
IHE	0.00717 (0.163)	0.00474 (0.108)	0.00360 (0.082)	0.0121 (0.279)
Familiarity		-1.277* (-1.731)		-1.478* (-2.036)
Complexity		-1.334 (-1.693)		-1.908** (-2.347)
Satisfaction			1.068 (1.538)	1.233* (1.878)
_cons	28.98*** (4.839)	30.28*** (5.574)	27.88*** (4.929)	30.84*** (5.503)
N	495	495	495	495
r ²	.07811152	.07032888	.06541468	.09987581

t statistics in parentheses

Table 5 Knowledge acquisition

	(1) Knowledge Acquisition	(2) Knowledge Acquisition	(3) Knowledge Acquisition	(4) Knowledge Acquisition
Tenacity	-0.439 (-0.417)			-0.818 (-0.783)
Leveling Terms	-0.123 (-0.113)			0.0306 (0.027)
Centrality	-2.241*** (-2.871)			-2.658*** (-3.251)
Population	0.00168 (1.093)	0.00175 (1.172)	0.00184 (1.231)	0.00146 (0.951)
HDI	-0.000309*** (-3.717)	-0.000318*** (-3.832)	-0.000317*** (-3.753)	-0.000310*** (-3.682)
IHE	0.0316 (0.710)	0.0343 (0.810)	0.0306 (0.686)	0.0346 (0.768)
Familiarity		-1.304* (-1.859)		-1.976*** (-2.751)
Complexity		-1.250 (-1.297)		-1.336 (-1.369)
Satisfaction			-0.988 (-1.074)	-0.926 (-0.999)
cons	20.14*** (3.295)	20.01*** (3.438)	18.84*** (3.274)	23.21*** (3.833)
N	495	495	495	495
r ²	.21565016	.20979442	.20754934	.22475123

t statistics in parentheses

Discussion and Interpretation of the Findings

Both H1a and H1b are supported, indicating that concentration has significant negative influences on both knowledge creation and evolution from a general view. Specifically, the reflective variables under concentration vary to some extent in this hypotheses group. Regarding the Hypothesis 1a: Chinese provincial governments' emphasis on concentration negatively affects the regional knowledge creation, tenacity and leveling terms have demonstrate their negative effect in a significant way on knowledge creation in both the baseline model only including the reflective variables of concentration and control variables and the final full model. Compared with the baseline model, the fixed effect coefficients of tenacity and leveling terms in the full model are significant at a higher level of $p < 0.05$, which are respectively -1.653 and -1.436 with all the controlled variables and all independent variables involved; thus, the final model holistically demonstrates the overall effects of provincial governors' cognition influencing knowledge evolution. Meanwhile, the r^2 value is also higher. The results show that the increased repetition of concentration in the provincial governments, i.e. tenacity and leveling terms will reduce the possibility of knowledge creation aspect of regional innovation. For hypothesis 1b: Chinese provincial governments' emphasis on concentration negatively affects the regional knowledge acquisition with significance, the coefficient of centrality shows a significant negative effect on knowledge acquisition at the highest level of $p < 0.01$ with the values of -2.241 and -2.658 in the baseline model and the full model. The regression results show that the provincial governments' emphasis on concentration negatively affects their provinces' regional innovation capacity from knowledge evolution perspective including both endogenous knowledge creation and exogenous knowledge acquisition, and the effect on knowledge creation is stronger because more significant reflective variables are involved. Concentration emphasized by central government is actually a reasonable policy of 'nation-building' intended to ensure social cohesion (Holtug, 2021) or solidification of a viable collective identity (Wolczuk, 2000). To be more specific, the concentration in China has the purpose of pooling all resources to complete major missions and achievement major development goals for the sake of deficiency of resources and talents as a developing country. From a provincial view, a simple and perfunctory copy of the central governments' tone is a relatively blind and short-sighted action by putting the characters and actual conditions of their own provinces aside. For those provinces which have ever been the focus of concentration and benefited a great deal from the policy of concentration promoted by the national government, they have already made some progress in knowledge creation and knowledge acquisition, and what they should highlight might be the regional balanced development in different fields instead of keeping focus on knowledge evolution in limited fields or accelerating the regional disparities and knowledge diversity within the area. However, for those provinces which have ever been excluded from the concentration policy, they have little experience of knowledge creation or knowledge acquisition. The more emphasis they put on concentration, the more possibly they might be trapped in the passive position of flinching from the challenges because of their habitual thinking set caused by their past experiences of giving away the innovative chances to those more developed provinces. Therefore, provincial governments should relocate themselves in the process of regional innovation and avoid the cocoon from previous national guidance.

Hypotheses group 2 on the negative relationships between the cognition of realism and regional knowledge evolution are supported as significant but no in all independent variables. For hypothesis 2a: Chinese provincial governments' emphasis on realism brings about negative effect on regional knowledge creation, our findings show that the

reflective variable of familiarity casts a negative shadow in both the base model involving only the two reflective variables of familiarity and control variables and the full model, with the first showing a coefficient of -1.277 and the last -1.478 at the level of $p < 0.1$. The fix-effect coefficient of complexity is negative but not significant in the baseline model. However, in the full regression model, the coefficient is -1.908 and the negative effect of complexity is proved to be significant at a high level of $p < 0.05$ with a higher r^2 value. Concerning hypothesis 2b: Chinese provincial governments' emphasis on realism brings about negative effect on regional knowledge acquisition, the variable familiarity also performs a significant negative effect with coefficients of -1.304 and -1.976 respectively in base model and full model. Yet the significance varies from $p < 0.1$ to $p < 0.01$, and the r^2 value also rises to a higher level, demonstrating the good performance of the final full model. The coefficient of complexity keeps negative, but its effect is not significant. Influenced by existing beliefs, people are often biased in favor of information that supports their attitudes, intensifying the information cocoon effect (Peng and Liu, 2021), which can be considered as familiarity. In biased information search caused by their familiar cognitions, people might acquire misinformation or disinformation due to unconscious biases (Jonas and Ward, 2007; White, 2013). Therefore, we assume that the things and thoughts we are familiar with in real life will also play the role of comfort zone obstructing the impulse and motive force to create and acquire new knowledge and restricting regional innovation capacity. Moreover, the focus on over complexity of unpredictable and counterintuitive behavioral phenomena or civilized society's inability on the brink of collapse (Casti, 2013), as a hint of fear of difficulty or confusion in reality, will also inhibit the development of regional innovation from the angle of knowledge creation. The feelings of negativity expressed in the GWRs might yield harmful reactions in the innovating process, thus careful wording selection should come into political view and be given serious attention.

Hypotheses 3 are relatively simple involving only one single variable - satisfaction. In Hypothesis 3a and Hypothesis 3b, the researchers suppose that Chinese provincial governments' attention paid to satisfaction encourages regional knowledge creation and knowledge acquisition. H3a is supported but H3b is not, which indicates that positive attitude in the form of satisfaction boosts knowledge creation, but its effect on knowledge acquisition is limited. From the fix-effect regression results, we can find that satisfaction positively influences knowledge creation with a coefficient of 1.233 in a significant way in the full model. Besides the significance, the value of r^2 also raises from 0.065 in the base model to 0.0998 in the full model. However, the effect of satisfaction on knowledge acquisition has not been detected as significant in either model. Satisfaction, a subjective well-being or positive emotion which works as building blocks for flourishing and vitality (Alexander *et al.*, 2021), here is treated as a linguistic category of governors' affective feelings from an interdisciplinary angle. As far back as (Aristotle, 2012) philosophy of happiness in Nicomachean Ethics, we have already had a glimpse of the influence of positive psychology on living a good life and achieving development of human potential (Broadie, 2002). Pressman, Jenkins and Moskowitz (2019) interpreted from psychology field that positive affect is associated with flourishing and success across life domains including social, work, physical, and psychological health. The functional role of positive emotional emotions is also studied and proved effective in educational domain by the distinguished psychologist in her Positive Discipline (Nelsen, 2011). Thus, we assume the positive attitudes delivered by provincial management team will have a positive influence on provincial knowledge evolution, and it is proved that a higher level of governors' emphasis on

satisfaction will promote creation and generation of new knowledge in that province because of the affective support in political environment. While for knowledge acquisition, since it is more complicated involving more elements such as local inclusiveness and openness to external knowledge, regional economic level, regional protectionism caused by geographical proximity etc. instead of only being based on self-driven efforts, the influence from the purely subjective affection and encouragement may not be easily proved.

Conclusion

In this study, we address an important research gap in the intersection between the provincial governments' managerial communication and the regional knowledge evolution in China from the view of public entrepreneurship.

The research results demonstrate that the provincial governments' emphasis on concentration and realism have a negative influence on knowledge creation and acquisition, while the highlighted positive emotion of governments positively boosts knowledge creation. Based on fields of Common Good Principle, business ethics and psychology, the interpretation of governments' invisible tone paves a new way to understand knowledge domain of regional innovation capacity, which lays a solid foundation for recognizing and perceiving potentially opportunities, risks, and development for their regions from their richer and more in-depth cognition (Baron and Ensley, 2006; Brustbauer, 2014) in public entrepreneurship context. Provincial governors should be more aware of the proper expressions in their managerial discourse and policy recommendations to foster innovation. Moreover, comparative parallels can be studied in the future at varied levels of Chinese local government such as municipal, county, and township etc. or in other countries' regional governments to enrich the research results.

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