Deciphering the Scarcity of Innovative Talent in China: Insights from the Structure-Agency-Culture Framework

Yi Zhang

School of Information and electromechanical engineering,
Hunan International Economics University

Corresponding Author:
Yi Zhang
School of Information and electromechanical engineering,
Hunan International Economics University
No. 822, Fenglin Road (the 3rd.), Changsha, 410205, China
E-mail: scholarzhangyi@163.com

Received: December 20, 2024 **Revised:** June 30, 2025 **Accepted:** September 15, 2025

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Abstract

China has emerged as an economic superpower that rivals the United States in many ways, but challenges persist, especially a paucity of innovative talent. The question reportedly posed by the Chinese aerospace engineer and cyberneticist Qian Xuesen about why Chinese schools fail to produce outstanding science and technology talent became more urgent after the Coronavirus disease 2019 (COVID-19) pandemic. The percentage of graduates with higher education degrees continues to rise, yet their contributions to national development, such as industrial innovation and upgrading, have not increased proportionally. This hinders progress across diverse social strata and leads to social issues, such as a heightened structural unemployment rate. This article uses the structure-agency-culture (SAC) framework, a literature review, qualitative research, and comparative analysis to analyze the impact of factors contributing to this issue. The goal is to create guidelines for other nations, including Thailand, to address comparable social challenges.

Keywords: scarcity of innovative talent, China, Structure-Agency-Culture (SAC) framework, developmental challenges

1. Introduction

In 2005, the Chinese aerospace engineer and cyberneticist Qian Xuesen pointed to a noteworthy impediment in national development: the university system's insufficient emphasis on fostering innovation. He argued that the current education model suppresses creativity, resulting in a shortage of outstanding talent and a lack of significant innovative breakthroughs (Li, 2005). The Coronavirus disease 2019 (COVID-19) pandemic has refocused attention on this issue. China's industrial upgrading is constrained by a shortage of skilled professionals, while those with degrees in higher education are unwilling to engage in physical labor, or abandon white collar work.

Chinese President Xi Jinping (2017, pp. 203-204) has stated that 'innovation is the soul of development' as a key policy focus. However, the results of these measures remain unsatisfactory. Disparities in the research environment contribute to talent outflow, as some workers choose careers overseas for better opportunities or a more conducive environment to leverage top talent (Cao et al., 2020). The Chinese government describes the current situation as a bottleneck in several professions. A prominent example is the Chinese company Huawei, which faces sanctions partly because of its inability to manufacture advanced chips domestically.

Over the past two decades, scholars from China and other countries have investigated the reasons for a shortage of innovative talent. The resulting viewpoints may be categorized into six groups:

a) Silver (2011): insufficient human capital investment;

b) Liu et al. (2023): inadequate endogenous growth momentum;

c) Liu et al. (2022): lack of an innovation ecosystem;

d) Mullen (2019): a suppressive educational environment;

e) Farrell and Grant (2005): a disconnect between the talent and industrial chains; and

f) Song (2018): an absence of effective mechanisms for knowledge production and application.

These diagnoses focus specific individual factors and their impacts, without discussing mechanisms of relevant processes. However, they all try to find institutional, cultural, and social reasons. Therefore, relevant discussion should correspondingly develop a framework for examining diverse factors and their interrelationships, rather than a single cause.

This article is based on the structure-agency-culture (SAC) framework to clarify constituents of this dilemma and how and why they interact. The goal is to formulate guidelines for other nations, including Thailand, to create appropriate response strategies for local contexts.

2. The SAC framework

Hays (1994) recommended conducting social surveys from three different, but interrelated, perspectives: structural, including macro level factors such as social systems, organizations, and power dynamics; agency, individual or collective actions and their environmental impact; and cultural, cognitive and behavioral norms shared in social groups. Archer (1995; 1996; 2003) supplemented agency's reflective mediating role between structure and culture, facilitating inclusion of factors between these dimensions. Overall, the framework emphasizes social actors and their interactions, explaining behaviors that occur in a specific social structure and cultural context.

The SAC framework may be appropriate for investigating a scarcity of innovative talents. Willmott (2000) note that the framework is universally applicable to discussions on any social institutional structure comprising material conditions, interests, and ideas. Shortage of innovative talent reflects this aspect, including resource gaps, intense vying for interests, and ideological rivalry. This framework has been widely applied in social surveys; Van et al. (2023) showed that it can conceptualize and systematically explore structural and cultural conditions to facilitate realist evaluation. The SAC framework used in this article follows Figure 1.

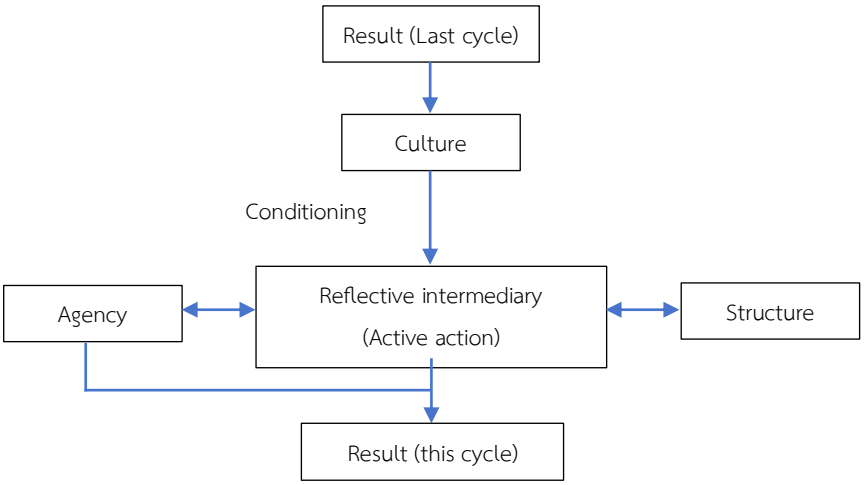

Figure 1 SAC framework diagram

3. Structural factors

3.1 Closed conservative attitude

Innovation deficiency is often linked to complacency with the status quo and a absence of motivation to explore potential problems. Isolation and conservativism are widespread in China's academic community, with reverence for outdated concepts and poor understanding of their limitations. For example, with knowledge classification, Chinese scholars follow established frameworks, directly hindering academic production (Song, 2018). Yet paradigm shifts may cause significant breakthroughs. In business, BYD Company Limited, a Chinese multinational manufacturing conglomerate, is dissatisfied with traditional fuel vehicle technology and invests resources in new energy vehicle manufacturing for industrial innovation.

3.2 Rigid academic achievement evaluation mechanisms

China's current academic achievement evaluation mechanism is inflexible, relying on quantitative indicators such as impact factors and citation rates to pinpoint research achievements and scholarly accomplishment. In this achievement-oriented culture (Parsons, 1951), academic production is not valued for individuality or creativity but transformed into a model resembling industrial production. The most blatant aspect of this schema is simplifying academic achievements into performance evaluations, without any profound understanding of scholarly research.

The Chinese method of quantifying academic achievements derives from the West, including bibliometrics, informatics, and scientometrics. In science policy, these are instruments for policymakers and researchers to measure impact and provide information for governmental and societal decision making on scientific governance (NSTC, 2008, p. 5). Instead, the Chinese academic community regards them as academic evaluation quantifiers; comparably, the Chinese state considered certain indicators as absolute measures of industrial and economic systemic growth during planned growth intervals.

So only articles published in journals listed on the Science Citation Index (SCI); Social Sciences Citation Index (SSCI); Advanced Host Controller Interface (AHCI); Engineering Index (EI); Chinese Social Sciences Citation Index (CSSCI); and academic conference proceedings are considered high-quality research. Drawbacks in this criterion include a heterogeneity of research output indicators and subjective biases potentially affecting the peer review process. Rendered less objective, these publications should form only part of evaluative data.

Performance evaluation reform in American academia tries to evaluate more comprehensively and objectively by diversifying quantitative indicators and reducing the weight of individual measures. Namely, the H-index enumerates the papers and citations of researchers as an indicator of the quantity and impact of academic output. Although limitations remain, a balanced approach results. China's academic evaluation system has not adopted such strategies, and has mainly regressed to a pre-1978 evaluation model, gauging academic achievements by publication administrative level.

Hence, in China innovative talents are pressured to prioritize publications with the best quantitative indicators, sometimes sacrificing inherent research goals. Additionally, overstressing core publications may perpetuate the aforementioned exclusionary practice. Historically, the London physician John Snow's water-borne theory of cholera transmission (1849) was erroneously opposed by core publications during outbreaks in Britain which privileged the miasma (bad air) theory (Mao, 2012). Opposition to emerging findings and researchers further hinders innovative talent development, as mentioned in terms of isolated, conservative academic attitudes.

3.3 Research climate impetuousity

The aforementioned rigid achievement evaluation mechanism has bolstered an impetuous research climate with scholarship conducted rapidly due to a sense of urgency. Fang (2022) emphasized that excessive reliance on specific quantitative indicators has led to much hastily superficial research. This current indicator-based evaluation of quantity and speed of academic output is self-contradictory; academic work should be evaluated based on quality rather than quantity or rapidity. Instead, thorough, meticulous scholarship is not ideally incentivized in an impactful research climate.

In the present environment, innovative or revolutionary work is unlikely to be produced. Researchers unable to conquer the evaluation system usually dare not propose high-risk disruptive innovation. This discourages academic output efficiency and may lead to downgrading career rankings. Similar phenomena exist in the business world, where with forced innovation, Baofeng Magic Mirror virtual reality (VR) products disregarded market competition and consumer demand, leading to competitive failure. Dismissing academic production that is inapplicable to evaluation systems, especially for innovative quality, impedes innovative development. Florida (2002) deemed tolerance, talent, and technology as equally important for cultivating creativity.

3.4 Unpublishable achievements due to author status

A common problem in Chinese academic publishing is that articles are accepted based on authorial status rather than inherent merit of new research.

Academic publications in China, especially journals and conference proceedings, often shift the focus of evaluation from a paper's content to the author's identity, including educational background, affiliations, professional rank, and project associations. Despite understandable reputational concerns, this myopic evaluation method diminishes the integrity of academic publishing.

Outstanding Chinese academics such as the mathematician Hua Luogeng, lacking a formal university education, and the historian and linguist Chen Yinke, persecuted during the Cultural Revolution, might well have had articles rejected according to today's personal identity criteria. By contrast, authors rated as personally acceptable may publish work irrespective of quality. They are even credited for publications in which they contribute no work. Regularly, Chinese students seeking to publish research articles must include bylines by established instructors to increase the probability of acceptance. This practice leads to insufficient academic mobility and fixed academic levels, which is unconducive to developing innovative talent. This tradition may have other negative consequences; suppressing potentially valuable academic work because of authorial unpopularity obstructs academic progress.

3.5 Excessive administrative intervention

Excessive administrative intervention in academia harmfully introduces executive power into academic discussions, creating power conflicts that damage academic integrity. This limits the autonomy of innovative talents, who must concentrate on survival in an administrative system rather pursuing research. Administrative intervention has also intensified a trend towards pragmatism and utilitarianism, leading to a focus on research with direct practical applications and benefits. And authoritarian administration turns the academic environment, especially administrative grading and a corresponding reward system for research, into a battleground for competing interests.

With excessive administrative intervention, authorities try to align academic research with their own interests, making academia into a decision-making device rather than one that pursues truth. As Boden and Epstein (2006) stated, governments attempting to control the knowledge production process, particularly in policy-based evidence, may distort research.

3.6 Decayed international exchange environment

Debates over lack of innovative talent in China usually overlook the decayed international academic exchange environment. Yet in addition to internal factors, the global context in which they operate should be considered. As Cao (2008) demonstrated, compared to the innovation atmosphere internationally, China's research environment is disadvantageous for producing high-quality publications.

Considering the transnational nature of academia, international academic exchanges provide a platform for Chinese innovative talents to showcase their achievements. This contact can help to dispel current limitations hindering growth and development. In mathematics, Wang Xiaowei, an undergraduate affiliated with Shanghai University, contributed to a number theory conjecture proposed by Richard K. Guy on the minimum number of crossings in planar drawings of complete graphs. The student's paper was initially rejected by a Chinese journal, but accepted by a Journal of Number Theory published abroad. (Anonymous, 2012) Similarly, Liu Lu, an undergraduate at Central South University, announced his solution of the so-called Seetapun Enigma, a mathematical puzzle proposed by the English logician David Seetapun, in the Journal of Symbolic Logic, published overseas, instead of a Chinese periodical.

4. Agency factors

Jiang (2011) described characteristics of an "innovative personality": independence; confidence; responsibility; foresight; ambition, skepticism towards dogma and consistency; affinity for novelty; appreciation of art and aesthetics; as well as a broad range of interests and focused abilities. In China today, few possess these qualities. Authors are influenced by social background, especially considerable peer pressure in the collective society of China, where individuals are easily shaped. Thus, this section focuses on how talent development and evaluation mechanisms form personalities.

4.1 The talent training system problem

The answer to Qian Xuesen's question is in China's flawed higher education system, where inherent problems are revealed by critical reflection. Chinese university education adopts standardized, closed training methods (Gao, 2016). These are cost-effective and can quickly prepare masses of professionals to meet societal needs. They are akin to the last man described by the philosopher Friedrich Nietzsche in "Thus Spoke Zarathustra," passive nihilists

who are tired of life, take no risks, and seek only comfort and security. Naturally, these are the antithesis of independent, visionary, and innovative talents.

Recent attempts to improve this situation, such as experimental undergraduate elite colleges, are only temporary solutions, not addressing the root cause (Chen, 2010). Additionally, the uneven quality of university teachers, a lack of enthusiasm for self-directed learning among students, and inadequate support infrastructure worsen contemporary Chinese higher education.

Cultivation of innovative talents cannot be limited to higher education; these issues stem from primary schooling. Primary and secondary education systems in China are exam-oriented, with schools like factories training students who pass exams. Motivated by indicators such as enrollment rates, student educational goals are limited to improving proficiency in standardized junior and senior high school as well as college entrance exams.

Parents continue this educational paradigm, considering exams as the sole route for social mobility and class progress. In traditional Chinese culture, parental “face” depends on academic performance of offspring. Consequently, the comprehensive development that students should experience, including moral, intellectual, physical, aesthetic, and labor education, has been overshadowed by rote learning. The latter approach ignores student interests and talents, leading to a lack of intrinsic student motivation to explore knowledge. Without such motivation, the innovative spark is extinguished. Test-oriented education fails to pat due attention to truly innovative talents due to its limitations as an educational model. These harmful effects extend to future academic research. Luo (2011, p. 169) observed that China’s exam-oriented education cultivates mediocrity and timidity, and scientific research is influenced accordingly. Which leads to the question of inherent flaws in China’s talent evaluation system.

4.2 Evaluation system issues

China’s talent evaluation system relies on a single evaluation standard, which has led to problems caused by Campbell’s law, according to which the more important a quantitative measure is for decision-making, the more likely it is to be manipulated and distorted, leading to negative consequences and undermining the original goal. A single evaluation method ignores independent thinking and exploratory interest needed to cultivate innovative talent. Current entrance exams require rote memorization and standardized responses. This undermines

any critical spirit or skepticism, rewarding mastery of test-taking techniques instead of knowledge. Extant exam preparation skills instills resistance to innovation. Originally intended to represent a spirit of ambition and progress, exam preparation as a basis for an education system, became a conservative ritual. Nan (2018, p. 766) described the system as “erasing the heroic spirit of several generations and limiting poetry to the conventions of the imperial examination”.

4.3 Talent selection problems

The imperial examination system suppression of independent thinking and exploration is reflected in the current Chinese evaluation system. Needham (2016, p. 319) observed that traditional Chinese imperial exams eliminated curiosity about natural law. In addition to methodic flaws, talent evaluation in China today is inefficient in recognizing creativity. Entrance exams fail to measure innovation potential and standards are unsuitable for evaluating innovation.

Allocating resources based on these standards has allowed unoriginal aspirants to waste budgets, while innovators go underfunded. Gresham’s law applies; when a resource’s value is determined by a flawed standard, inferior individuals or practices may drive out superior ones, discourage innovative talent, and strain the research environment.

5. Cultural factors

5.1 Pragmatic and utilitarian traditions

Rowland (1883) suggested that the ultimate human pursuit is wisdom, with pure science as a significant constituent. He observed that Chinese progress was hindered by contentment with mere application, without inquiring into underlying principles.

The traditional Chinese cultural stance towards knowledge involves introspection, focusing on utilitarian, pragmatic traditions. A disdain for useless things leads to opposition to rational, logical thinking. Rowland noted that basic or pure science struggles for recognition in China. A resulting modest demand for related talent favors conservators over innovators or pioneers.

Alternatively, Chinese cultural pragmatism and utilitarianism have shaped a key educational characteristic, the focus on transmitting knowledge and skills. In the present talent selection system, ruled by rote memorization, this feature is expressed by extreme reverence for established knowledge. Yet this worshipful attitude contradicts modern innovative

education in which talent must diverge from deliberate instruction of facts and techniques (Zhu & Zhu, 2011).

Pragmatism and utilitarianism become a form of anti-intellectualism prioritizing knowledge acquisition for personal material benefit. This notion has produced two opposing extremes: veneration of academic degrees as a means to personal advantage, and the counterview that such diplomas are futile. The latter perspective is gaining popularity in Chinese society, but still fails to challenge the dominance of the former in mainstream thought.

Given the divergence in their impact on social ideology, this article will confine itself to the damage to developing innovative talent of pursuing degrees entirely from self-interest. Students in China's talent cultivation and evaluation system have shown a self-serving ambition for academic credentials. As Yu (2019) noted, throughout history Chinese literati have comprised a significant group in the imperial examination system, seeing knowledge acquisition mainly as a means for personal profit.

However, unlike the past, the expected trajectory for this group in China has evolved beyond studying to enter the civil service. The paradigm of prestigious schools leading to superior employment, high salaries, and class mobility remains at play. Choices have now diversified, but the underlying rationale is the same. To answer the Qian Xuesen question, the recent trend of undergraduates pursuing university graduate degrees and governmental or state affiliated jobs reflects dissociated career paths.

High scorers on standardized tests, an estranged group, mainly benefit from China's talent cultivation and evaluation system. A media survey indicated that top scorers choose popular major fields of study because of their competitive advantages in job hunting and earning potential (Zhu, 2016). As Figure 2 shows, over the past two decades, universities have expanded enrollment. University elitism and academic integrity have been vanquishes, but at the cost of educational quality.

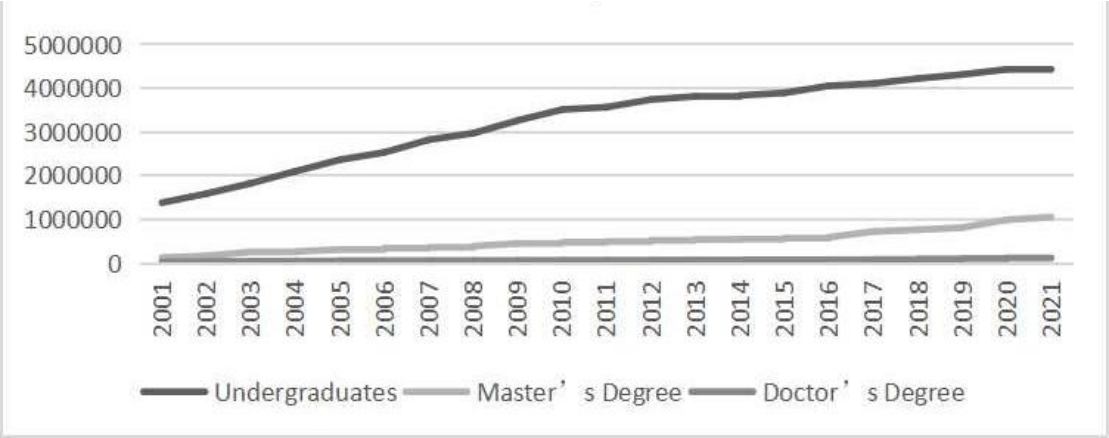

Figure 2 comparative numbers of entrants to Chinese formal education by type: undergraduate, master's degree and doctoral degree from 2001 to 2021

Sources: Ministry of Education of the People's Republic of China (26 August 2024) Education Statistics. Ministry of Education of the People's Republic of China (http://www.moe.gov.cn/jyb_sjzl/moe_560)

The Chinese government expanded university enrollment to accommodate economic system development, rather than to benefit universities or research. This is evident from a policy of promoting domestic demand, consumption, and economic growth, while alleviating employment pressure (Tang, 2017) as outlined in the university expansion plan.

As a result, an intense academic rivalry is unfolding in the context of Richard B. Freeman's controversial concept (1976) of overeducation. This escalating internal competition has prompted leading universities to focus mainly on entrance exam preparation as the central teaching objective. The basic purpose of cultivating university talent should be to nurture innovative talent, providing students with resources to develop freely and comprehensively. However, societal pressures such as employment rates and graduate exam success metrics have moved universities to standardize curricula to increasingly mirror the exam-oriented approach of primary and secondary education. This shift deprives innovative talents who previously avoided exam-centric learning to pursue aspirations and explore knowledge at university. Educational institutions, families, and society impose on innovative talents the paradigm of prestigious schools leading to superior, well-paid jobs and class mobility at their own risk.

By comparison, education in the United States emphasizes positivity and autonomy, encouraging exploration of interests rather than exclusively practical and utilitarian subjects; in this way, innovative talents may cultivate new individual approaches (Zhu et al., 2024). The Japanese model aims to transform similar traditions into modern technological development and market demand, turning cultural barriers into motivating forces (Wang & Yu, 2019).

5.2 No academic ethics

The Chinese cultural contempt for carelessness epitomized by the term Mr. Almost (*chabuduo xiansheng*; Hu, 2016) combined with East Asian shame culture (He, 2021), produces a lack of rigor and neglect of ethics and integrity in academia.

Academic misconduct is rife, comprising plagiarism; ghostwriting; forged research materials, simultaneous submission of articles to multiple publications; peer review evasion; false resumes, embezzlement, and counterfeiting. In 2023, three-quarters of global retractions due to academic misconduct occurred in China. The Chinese government was obliged to mandate ethical reviews by research institutions of authors of retracted articles (Mallapaty, 2024).

Academic corruption in China is formidable not just numerically, but in the complex technology employed. This ranges from directly stealing others' work; disassembling and reassembling; using pseudonyms; and preemptive publishing to difficult-to-detect indirect plagiarism (Yang, 2001, pp. 46-69).

Additionally, the Chinese academic community punishment mechanisms malfunction, resulting in few sanctions associated with academic misconduct. Development of innovative talent is hindered because discouragingly, intellectual property rights cannot protect achievement.

5.3 Circular culture

Fei (2022) observed that Chinese society operates in a differential mode of concentric circles of relationships (*Chaxu geju*). This paradigm has led to two significant phenomena for the academic community: nepotism and exclusivity towards non-mainstream academia.

The circular culture has caused nepotism to the point where administrative authority intervention became necessary. The state proclamation *Opinions on Further Advancing the Spirit of Scientists and Strengthening the Construction of Work Style and Study Style* is one example.

With nepotism, research depends on extra-academic interactions with recognized figures in a field. Its prevalence, along with favoritism, has stagnated development and encouraged conservatism. Innovative talents lacking social connections are often marginalized or excluded by the circles in their professional fields.

When who, instead of what, is known becomes the basis for evaluation of work, exclusivity of non-mainstream academia results. To this extent, the requirements of circular logic and academic discourse are inconsistent. The dominant circle harms the autonomy of the academic community, weakening individual autonomy and collective effectiveness of scholars. Anonymous (2019) deemed circular logic inconsistent with requirements of academic discourse. Obstacles created have promoted isolated schools of thought and a lack of knowledge exchange. In this environment stifling individual autonomy, independent innovative talent is scarce. Researchers must master complex social relationships instead of focusing on knowledge.

Globalized internet culture is an opportunity to dissolve circular culture by widening platforms and eliminating its closed, exclusive nature. However, Chinese closed Internet policy and the aforementioned anti-globalization deterioration of international exchange counteract this possibility.

5.4 Absolute collective culture

Chinese traditional culture prizes the collective over the individual, with three key tenets: minority deference to the majority; social cohesion achieved by suppressing individual difference for collective advances; and expecting unquestioning obedience to power from underlings. This collectivist ethos in traditional culture has obstructed the nurturing of innovative talent.

For instance, training and evaluation mechanisms for talent represent an unconscious cultural reflex. Innovative talents are often a dissenting minority, denied a voice in Chinese society where conformity is paramount. By suppressing individuality, assimilating individual thought to collectivity pressures innovative talents to meet societal norms, trading uniqueness for a collective identity. In such a society, innovative talents forfeit freedom to develop independently and face peer expectations of conformism. A risk of creative decline ensues.

Furthermore, the societal tradition of lower class deference to upper classes fosters inequality and authoritarianism. In an unequal society, innovative talents may become reliant on the powerful, who are more concerned with preserving their dominance than scholarship.

Moreover, authority often demands reverence that may be opposed to the quest for knowledge.

Innovative talent might try to leverage social norms to augment their influence and amplify their voice but this is usually impossible, given China's ineffective talent cultivation and evaluation mechanisms.

5.5 Ignoring the concept of vocational education

The phrase "Those who labor with their minds rule others; those who labor with their strength are ruled by others" (*laoxinzhe zhiren, laolizhe zhiyu ren*) is a maxim from the ancient Chinese philosopher Mencius, expressing a traditional view of social hierarchy where intellectual workers hold authority over manual laborers (Mencius, 1922, p. 11b). This viewpoint has perpetuated a hierarchy where manual laborers and their associated skills and knowledge are relatively misesteemed. So vocational education occupies a low tier in the educational hierarchy, often seen as an option for academic failures.

Practical issues, such as inadequate protection of labor rights and low wages for manual workers in China, further disincentivize choosing vocational education. Despite legal provisions for workers' rights, including the right to rest, manual laborers often lack safeguards (Mu, 2020). The wage issue is twofold: the disparity between long working hours and low earnings, and the income gap when compared to mental laborers (Anonymous, 2022). Thus, Chinese vocational education fails to equip students with skills demanded by society for relevant positions, while those in conventional high schools and higher education often graduate without practical skills, despite aspiring to high-income mental labor based on academic credentials.

The disdain for manual work disrupts the relationship between technology and science, preventing scientific advancement. Moreover, the resulting lack of hands-on experience, operational knowledge, and skills can impose cognitive limitations, constraining innovation capacity.

5.6 Absence of critical atmosphere

In contemporary society, China's dearth of innovative talents has not been accorded full attention. Ihe Communist Party of China (CPC) and its government have implemented measures to address the issue, with limited success, especially after college entrance examination reform in 2008. Such measures failed to identify and address the causes of this social dilemma, leading to stopgap experimental policies. Even ideologically, the core issue has

not been identified. For instance, Chinese nationalist thinking labels as traitors any innovative talents who accept opportunities abroad, an extremely biased perspective.

Wide social understanding and active engagement may resolve the predicament. The English historian Arnold Toynbee (2010, pp. 82, 247) suggested that a civilization's decline is rooted in a loss of creativity among a few innovative groups. Historical discourse on the impact of civilization by a few innovative talents underscores their role in the vitality, survival, and progress of a civilization, nation, or collective. However, in a culture without criticism, people see purveyors of new ideas as outsiders.

So China faces a critical impasse, managing crises worsened by a paucity of innovative talent. Paradoxically, these issues are often sidestepped or become taboo because societal criticism is typically seen as a form of attack.

6. Further discussion

The dimensions of causes and their interactions are shown in Figure 3.

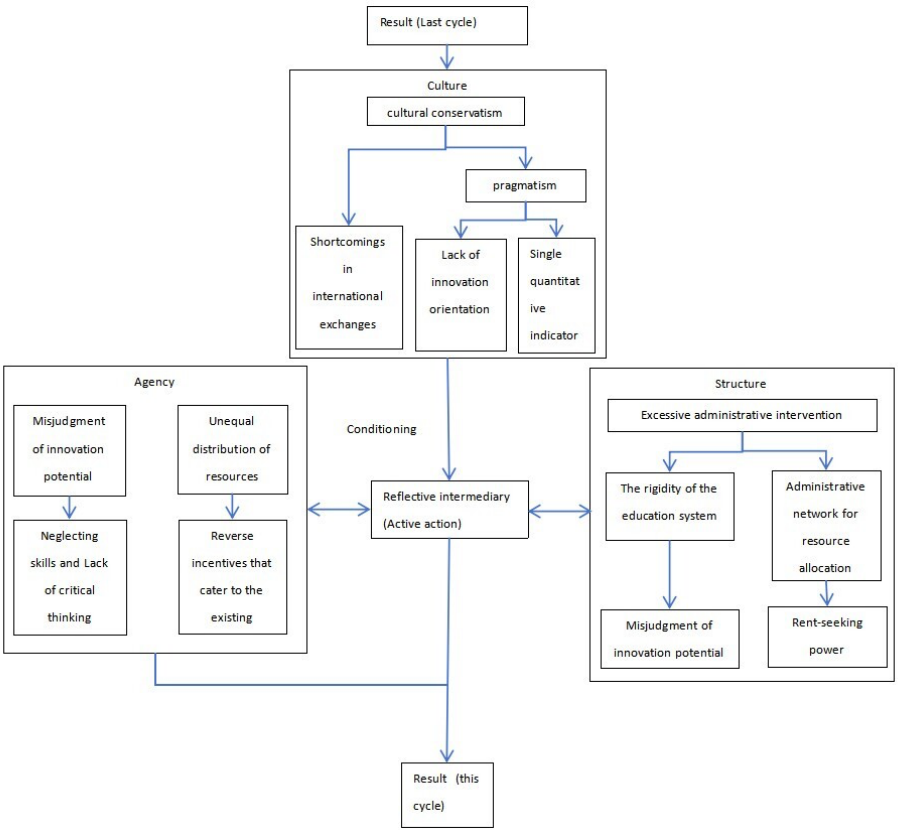

Figure 3 The relationship between diverse factors

Note: some words are replaced to facilitate logical expression in the diagram. The significance of color continues from Figure 1.

These factors and their interactions are due to a logic of excessive control and administrative intervention caused by power dominating political achievement in bureaucracy. This derives from pre-modern society's pursuit of controllable outcomes to achieve planned effects of innovative activities. However, in pre-modern and modern society, innovation may be spontaneous, leaving the logic of excessive control logic unproductive due to its limitations on open free environments.

7. Conclusion

This article uses the SAC framework to analyze and re-evaluate factors leading to innovative talent shortages in China. The Qian Xuesen question is answered, linked to China's social structure, institutions, and culture that have aggravated this situation. Efforts for change should focus on resolving the logic of excessive control. Therefore, specific reform measures may be proposed, such as implementing Finland's project-based learning to counteract a rigid basic education system. This approach cultivates students' innovative thinking and problem-solving abilities through active thinking and exploration, more effectively than force-feeding knowledge of use solely during exams. This is confirmed by Petrytsa's (2024) comparison of project-based learning outcomes in primary education internationally.

These findings reflect the policy-oriented role of academic exploration in addressing real-world challenges and offer guidelines for other nations, including Thailand, to address social conditions and formulate strategies in the context of comparable social development issues.

Acknowledgment

I would like to express my gratitude to the editorial team of the Thai Journal of East Asian Studies. Their effective and patient communication significantly improved the language expression of this article and made it more accessible to readers from non-Chinese backgrounds. Additionally, I extend my thanks to the three reviewers who read the manuscript. Their suggestions enabled me to refine my research and enhance its presentation in the article.

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