

studies can be defined as a research strategy or an empirical inquiry that investigates a phenomenon within its real-life context. Case study-based research can involve single or multiple case studies, which can include quantitative evidence and multiple sources of evidence, while benefiting from the prior development of theoretical propositions. Case studies should not be confused with qualitative research, as they can be based on any mix of quantitative and qualitative evidence. Single-subject research provides the statistical framework required to make inferences from quantitative case study data <sup>[15, 18]</sup>. This view is supported and well formulated by Lamnek: “The case study is a research approach, situated between concrete data taking techniques and methodological paradigms” <sup>[19]</sup>. Therefore, in this report, the main study object will be one individual provincial capital based on careful selection.

### **3.2. Secondary data analysis**

Quantitative research is used to test hypotheses derived from theory and to estimate the size of a particular phenomenon. When using statistical methods, quantitative research starts with the collection of data, based on the hypothesis or theory. Causal relationships are studied by manipulating factors that influence the phenomena of interest while controlling other variables relevant to the research objectives. During the quantitative research process, researchers use either primary or secondary data. Secondary data is information collected by someone other than the user. Common sources of secondary data for social science include censuses, organizational records, and information collected through qualitative methodologies or qualitative research.

Analyzing secondary data saves time that would otherwise be spent collecting information. In the case of quantitative data, secondary sources provide larger and higher-quality databases that an individual researcher would struggle to collect on his or her own. Analysts of social and economic change consider secondary data essential, since it is impossible to conduct a new survey that can adequately capture past change and developments.

Like primary research, secondary data can be obtained from different research strands, including documentation such as censuses, housing information, and social security. Secondary information can also be gathered through electoral statistics and other related databases, such as Internet searches, libraries, and progress reports.

A clear benefit of using secondary data is that much of the background work has already been carried out. In addition, the wealth of existing information available means that secondary data generally has a pre-established degree of validity and reliability; this means it does not need to be re-examined by the researcher.

Views regarding the role of measurement in quantitative research are somewhat divergent. Measurement is often regarded as a means by which observations are expressed numerically in order to investigate causal relations or associations. However, it has been argued that measurement often plays a more important role in quantitative research <sup>[20]</sup>. For example, Kuhn argued that quantitative research occasionally elicits unusual results <sup>[21]</sup>. This is because accepting a theory based on the results of quantitative data could prove to be an aberration. He argued that such abnormalities are interesting when discovered during the process of data collection because: “When measurement departs from theory, it is likely to yield mere numbers, and their very neutrality makes them particularly sterile as a source of remedial suggestions. But numbers register the departure from theory with an authority and finesse that no qualitative technique can duplicate, and that departure is often enough to start a search.”

Therefore, this report will adopt a qualitative and descriptive approach based on case studies of individual cities around the world.



## **4. Data resource**

### **4.1. Municipal data**

The optimal data source for this report should be gathered from the statistics department of any prefecture-level city in the Pearl River Delta region 20 years ago, which is the incipient phase of the “Reform and Opening-up” policy. During this period, lots of foreign investment was attracted to this region, due to the massive market of mainland China, and the affordable labor cost as well. Also, the section need to be checked are 1. number of establishments in the clothing industry, 2. number of persons engaged in the clothing industry, 3. external direct investment. However, on the website of the Statistics Bureau of Shenzhen Municipality, the earliest data was 2005. Therefore, this report will give more attention to the implication one specific company, rather than a specific city.

### **4.2. Zara**

In this report, the chosen case is Zara. It is one of the world’s most successful fast fashion retailers <sup>[22]</sup>. By studying these particular companies, this report could provide some insights into the process of the fast fashion industry. The most concerning sections of these companies will be their annual turnover, their subsidiaries, their business model, new style, etc.

## **5. Data analysis**

One of the main changes brought about by globalization across and within the fashion industry is the number of companies involved getting bigger than before. The outburst of companies leaves others a lot of options to choose from, and therefore, in the fashion industry, clothing companies are able to choose the cheapest manufacturing company throughout their production processes. This decision is made under the assumption that the clothing company is a rational player in the market and that it will try to minimize its costs to gain greater profitability. As a result, the former job opportunities provided to local workers before are shifted to the developing countries to lower company costs <sup>[23]</sup>. These firms generally let workers in developing countries occupy the low-tech tasks in their supply chains.

Another change is the scope of geographic location, as the number of companies involved is now not as limited by their location. Indeed, if any company wishes to find an appropriate partner, the range of choice is now not just local or regional but global <sup>[24]</sup>. With this leeway being so generous, a fashion company could have an in-depth comparison between all its competitors and find the most suitable partner with the best quality and lowest prices. Reduction of the product itself would potentially lower its selling price and increase the product’s competitiveness with others on the market.

Other than the two reasons listed above, the fashion industry’s greater investment in developing countries could also be explained by “competitive advantage” <sup>[25]</sup>. Since the manufacturing industry was highly focused within developing countries from an early stage, this helped them to gradually enhance their productivity throughout their history, and eventually bring them a reputation for producing certain types of product, for instance, cashmere from Scotland.

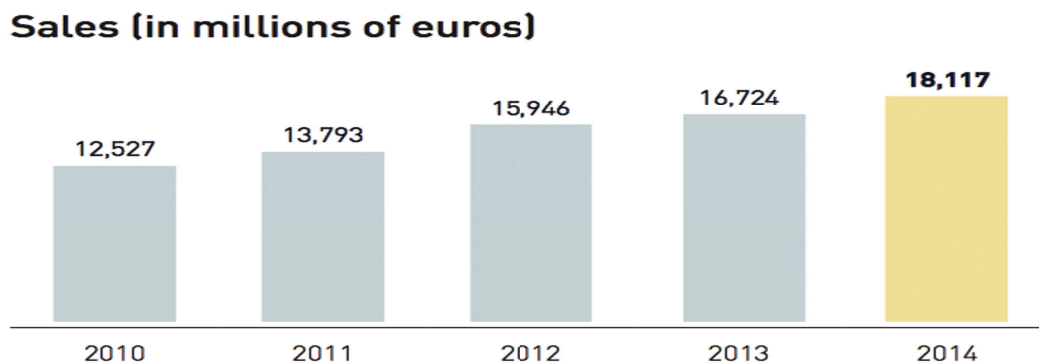
## **6. Implication to Zara**

Berle and Means indicated that with modern joint-stock company equity, dispersed ownership and control of the present situation could be separated, giving control of the company to company managers <sup>[26]</sup>. The authors

argued that control is manifested through the exercise of legal rights or influences, and has a practical choice for most directors. Jensen and Fama indicated that, according to this, an enterprise's decision-making process will be divided into business decision-making, decision management, and decision control; with the former referring to resource utilization and the structure of the contract and execution and approval of decisions, namely decision proposals and enactment <sup>[27–28]</sup>. The latter refers to the requirement to carry out the proposed decisions and performance and rewards of assessment decision agents, namely, decision acceptance and supervision. The concentration of power in big fashion companies would be seen through the culmination of their power through mergers and take-overs <sup>[29]</sup>. The highly-concentrated power in a big company would lead to several potential results, and the most obvious four will be discussed below.

The first result is the fact that the control company will take advantage of consumer demands or behaviour, and, in some cases, even their lifestyles <sup>[30]</sup>. This kind of violation of privacy would help them to produce a product that fits the description of what their customer's need. In this way, they would enhance their market share and concentrate more power to themselves.

Secondly, the big companies—those that currently have more power than others—would create lax regulations on takeovers and mergers, as shown in **Figure 1** and **Table 1**, though this means they will be able to put pressure on smaller, newly-developed companies more easily than before <sup>[31]</sup>. Given the fact that the company that concentrates power usually in larger scale than the newcomer, these take-overs can sometimes even eliminate the smaller firm. As a result, big companies may be able to wipe out any potential competitors if they are regarded as a threat, which will further ensure that their market share is not encroached upon by others.



**Figure 1.** Zara's annual turnover from 2010 to 2014; Source: Inditex Annual Report 2014

**Table 1.** Brands under Inditex

Company	No. of shops[28]	Year of creation
Zara	2,143	1975
Pull and Bear	922	1991
Massimo Dutti	729	1995 (acquired)
Bershka	1,032	1998
Stradivarius	937	1999 (acquired)
Oysho	598	2001
Zara Home	481	2003
Uterqüe	71	2008

Thirdly, big companies are able to exploit development in the fashion industry. Compared with other companies, they have more human resources and funds by which to develop new technologies. These firms put forward the development of the whole industry and create greater diversity of materials, fabric patterns, and textiles<sup>[32]</sup>. As shown in **Figure 2**, this advanced new technology applied to their own unique products would give more options for the customer, thereby potentially appearing more attractive to them and leading them to buy these products.

## **ZARA'S BUSINESS MODEL**

Zara's business model can be broken down into three basic components:

1. **Concept:** To maintain design, production, and distribution processes that will enable Zara to respond quickly to shifts in consumer demands.
2. **Capabilities:** It maintains tight control over their production processes keeping design and manufacturing in-house or with some strategic partnerships located nearby. They have strategic agreements with local manufacturers that ensure timely delivery and service. Thus, maintaining the flexibility necessary to design and produce over 12000 new items annually.

**Figure 2.** Zara's business model

Finally, big companies are able to exploit new management processes<sup>[33]</sup>. They would take specific actions and techniques, such as the "Just in Time" (JIT) production systems and loyalty cards. This renovation of the management process would help them have a more accurate customer orientation, as well as more efficient production lines. In return, this would help them draw the attention of new customers, thereby enlarging their market share.

However, the adverse impacts brought about by globalization have targeted two specific areas. With regard to local economies, globalization will cause a decline in smaller shops and independent retailers<sup>[34]</sup>. Losing its carrier, local fashion cultures and diversity might become lost throughout the process of globalization. Another affected area is that of consumers and society; consumers will suffer lower-quality units since every company will choose the lowest manufacturing costs, and this will eventually bring about environmental challenges. For instance, "Fast Fashion" generated considerable waste, as old fashion becomes "out of style." Indeed, in America alone, 68 pounds of clothing and textiles are thrown away by every person each year. Also, the harvesting of raw materials and the growing need for cloth will mean that the nations of origin for raw materials will release pesticides upon cotton crops, potentially poisoning agricultural land.

## **7. Conclusion**

In conclusion, the differences brought about by globalization in the fashion industry may be summarized into four specific performances. First of all, design is more appropriate for a wider market, including the European and Asian markets. Besides the design, the chosen fabrics appear to be more diverse. Second, the trend of moving manufacturing processes to the cheapest site in the world. Third, larger companies would spread their

store distribution more widely than before to obtain a wider, global market share. Finally, this would help the big companies to adopt the multi-level hierarchy management system, because only in this case will they be substantial enough to run business across different parts of the world.

## Disclosure statement

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# Strategic Communication Frameworks for Brands in Navigating Sensitive Social Discourse: A Case Study of SK-II's "Marriage Pressure" Campaign

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**Abstract:** Focusing on SK-II's advertising campaign addressing marital pressure, this study examines how multinational brands engage with locally sensitive issues in the Chinese context. Drawing on emotional branding, post-feminist discourse, and affective publics, the study analyzes how documentary-style visuals and moderated narration transform women's everyday experiences into shareable emotional structures while managing cultural risk. Through open-ended storytelling, the campaign enables audience reinterpretation and circulation across social media, extending beyond a commercial text into a relational medium. The findings suggest that communicative effectiveness depends on nuanced representations of lived experience and the accommodation of diverse audience interpretations.

**Keywords:** Transnational brand communication; Sensitive issues; Moderated expression; Affective narratives; Audience negotiation

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## 1. Brand narratives around sensitive issues

In recent years, brand communication has increasingly moved away from a focus on functional attributes toward the construction of value-oriented and emotionally grounded narratives. Issues that were once considered private, including gender, family, and personal identity, are now frequently incorporated into advertising as a means of establishing relational proximity with audiences. Yet such issues are deeply embedded in culturally specific emotional structures. When addressed without sufficient sensitivity, they can easily generate discomfort or resistance. For this reason, how brands can engage with socially sensitive issues without intensifying cultural tension has become a critical question in contemporary communication practice.

Within the Chinese social context, marital pressure does not operate as an individual dilemma alone. It

is shaped by family ethics, intergenerational expectations, and enduring social norms. SK-II's campaign takes marital pressure as its narrative focus and depicts women's hesitation, silence, and emotional restraint in everyday family interactions and matchmaking situations. Rather than advancing an explicit evaluative stance, the campaign adopts an observational mode that resembles documentary storytelling. Through this approach, marital pressure is rendered as an affective condition that can be sensed and recognized, rather than judged or resolved. By privileging lived experience over overt commentary, the campaign adopts a communicative position that remains accessible to audiences while avoiding direct cultural confrontation.

This article does not aim to provide a sociological analysis of marital pressure as a social problem. Instead, marital pressure functions as an analytical entry point through which broader strategies of brand communication can be examined. The analysis addresses three interrelated concerns. It explores how the campaign connects women's everyday experiences with brand values through affective narration, how the brand articulates a value orientation while maintaining sensitivity to cultural risk, and how audiences participate in the ongoing construction of meaning through circulation and reinterpretation. Taken together, these dimensions illuminate how multinational brands negotiate sensitive issues within localized cultural environments.

## **2. Communication perspectives on brand, gender, and affect**

The representational logic of SK-II's campaign can be understood in relation to broader transformations in brand communication, where emotional experience increasingly serves as the foundation for relational engagement. Rather than relying primarily on functional persuasion, contemporary campaigns often seek to create atmospheres that invite recognition and emotional proximity.

Within brand studies, emotional experience has long been recognized as central to the formation of brand relationships. Morrison and Crane argue that affective environments often exert greater influence than rational information in shaping audience attachment <sup>[1]</sup>. In the SK-II campaign, restrained pacing, minimal dialogue, and a documentary-style visual language work together to create an empathetic viewing space. Viewers are not instructed on how to interpret the narrative. Instead, they are encouraged to encounter it through feeling. This affective orientation allows the brand narrative to resonate with women's everyday emotional experiences without requiring explicit alignment.

From a gender perspective, the campaign reflects a moderated mode of representation. Gill observes that advertising frequently employs soft discursive strategies that avoid direct confrontation with structural inequality while still offering positions of emotional identification <sup>[2]</sup>. In the Chinese context, research by Tian Wang and Tianhui Tan suggests that audiences often engage with such expressions in an ambivalent manner, where emotional resonance is accompanied by an awareness of commercial construction <sup>[3]</sup>. In the SK-II campaign, themes such as understanding, companionship, and personal choice are foregrounded, while institutional contradictions remain implicit. This balance contributes to the campaign's acceptability and facilitates its circulation within public discussion.

Digital circulation further amplifies the role of affect. Papacharissi conceptualizes affective publics as formations in which emotion circulates through sharing, commentary, and reinterpretation <sup>[4]</sup>. As the campaign is recontextualized across platforms, marital pressure shifts from an individual experience to a collectively recognizable emotional condition. Meaning is extended through audience participation rather than stabilized by the brand alone.

Hall's encoding and decoding model underscores that meaning emerges through use rather than unidirectional transmission <sup>[5]</sup>. Couldry similarly emphasizes that media narratives are employed by individuals to organize everyday experience and make sense of social relations <sup>[6]</sup>. Audience responses to the SK-II campaign range from personal identification to cautious distance and critical reflection. Together, these responses shape the campaign's public significance and demonstrate that its communicative effectiveness lies in the interaction between affective design, moderated gender representation, and participatory circulation.

### 3. Communicative contexts of the advertisement

The communicative impact of the campaign is closely tied to its narrative rhythm and visual organization. The advertisement unfolds at a measured pace, foregrounding silence, hesitation, and subtle changes in expression. Emotional meaning emerges through pauses rather than verbal explanation, allowing viewers to follow emotional trajectories instead of receiving predetermined conclusions. In this way, marital pressure is gradually brought into view through imagery rather than argument.

Interpersonal relationships are depicted with restraint. As shown in **Figure 1**, a woman falls silent upon hearing her mother remark, "that's why she's leftover." While the visual focus remains on the daughter's reaction, the spoken line is delivered from an off-screen position. This separation between image and voice allows generational expectations and individual experience to converge within a single moment. Marital pressure is thus presented as an accumulation of emotional negotiation rather than a site of direct confrontation.

Spatial contrasts further reinforce this dynamic. Quiet domestic interiors are juxtaposed with the noise of matchmaking venues, illustrating how pressure operates across private and public spheres. While the campaign renders this lived reality visible, it avoids extreme judgment, thereby maintaining cultural sensitivity. The alternation between women's self-narration and parental perspectives constructs a shared condition of communicative impasse rather than a clear antagonism.

The open-ended structure of the advertisement leaves interpretive space for subsequent circulation. By refraining from offering solutions, the campaign invites audiences to continue meaning-making through sharing and reinterpretation. As a result, the advertisement extends beyond a fixed brand text and becomes a resource for broader social expression.



**Figure 1.** Daughter falls silent while hearing her mother's remark (Screenshot from SK-II: Marriage Market Takeover)



## 4. The issue brought into view

In urban Chinese life, marital pressure often manifests in subtle yet persistent ways. It surfaces through routine family conversations, matchmaking arrangements, and social gatherings. Although it rarely appears as overt conflict, it accumulates through everyday interaction and carries both private emotional weight and public significance. This dual character enables the issue to resonate widely without requiring explicit politicization.

Compared with more overtly confrontational gender issues, marital pressure is particularly amenable to narration through personal experience. While younger generations have gained greater room for individual choice, parental expectations surrounding family stability remain influential. These positions are not inherently irreconcilable, yet they often diverge in modes of expression. Direct negation of family relations risks resistance, while avoidance renders women's experiences invisible. SK-II's approach lies in juxtaposing different perspectives in a manner that allows mutual recognition to emerge.

For multinational brands, the challenge lies in identifying expressive forms that remain intelligible within local cultural logics. Abstract slogans such as female autonomy often acquire divergent meanings across contexts. By grounding its narrative in lived experience, the campaign situates brand expression within everyday reality while preserving interpretive openness. Digital recirculation further enables this issue to enter public discussion through personal narration and emotional sharing.

## 5. Strategies of Moderated Expression

Gender-oriented brand campaigns often rely on explicit value declarations that articulate clear normative positions. While such strategies can generate visibility, they also increase the likelihood of controversy. In contrast, SK-II's campaign refrains from direct judgment and instead presents marital pressure through moderated affective narration. This approach reflects a careful assessment of cultural sensitivity, audience receptivity, and the boundaries of public discussion.

Affect functions as the primary communicative medium. Rather than persuading through argument, the campaign allows women's situations to unfold through visual detail, silence, and pacing. Narrative openness enables viewers to recognize their own experiences without being compelled toward a fixed interpretation. This openness sustains discussion while preventing the narrative from crossing sensitive cultural thresholds. Morrison and Crane emphasize the importance of emotional experience in the formation of brand relationships<sup>[1]</sup>.

At the level of gender representation, moderated narration does not weaken female subjectivity. Instead, it responds to local cultural conditions in which emotional authenticity conveyed through everyday detail is often more acceptable than direct critique. Conflict is rendered relational rather than oppositional, allowing multiple positions to coexist without requiring resolution.

Moderated expression also extends the campaign's communicative lifespan. Zhou and Jin suggest that affective resonance facilitates circulation through processes of emotional extraction and self-projection<sup>[7]</sup>. As audiences incorporate personal narratives into secondary dissemination, the campaign becomes an emotional resource through which individuals articulate experience. This transformation supports sustained visibility within public discourse.

## 6. Narrative meaning from the audience perspective

When examining how brands engage with sensitive issues, audiences should not be understood as passive

viewers, but as active participants who continuously adjust, extend, and at times rewrite brand narratives from different social positions. If SK-II's campaign on marital pressure were treated merely as a one-way transmission of brand messaging, many phenomena observable in its circulation would remain difficult to explain. Only by incorporating audiences' interpretive experiences, emotional responses, and narrative practices can we understand how the campaign persists within public discussion and acquires significance beyond the logic of marketing communication.

Discussions on social media reveal the emergence of multiple viewing positions surrounding the campaign. Some female viewers interpret the advertisement as an affirmation of their own circumstances, recognizing long-standing yet difficult-to-articulate experiences through moments of silence and family dialogue. Others maintain a more cautious stance, acknowledging the campaign's affective expression while remaining attentive to its commercial nature. Still others adopt a critical perspective, questioning the advertisement's limited engagement with structural sources of inequality, such as gendered divisions of labor. The coexistence of these positions keeps the meaning of the advertisement in a continuous process of negotiation and adjustment.

These differences are closely tied to audiences' social locations, gender roles, and generational relations. Younger viewers often read the campaign as a rehearsal of possible future situations, while older generations, when participating in discussion, may reassess their own practices through the narratives of others. As a result, the issue no longer refers solely to women's experiences, but mobilizes broader familial understandings of expectation, responsibility, and emotion. Meaning is thus reassembled within audiences' lived contexts rather than defined exclusively by the brand.

Audiences do not merely evaluate the campaign, but actively deploy it within everyday interaction. Some users attach personal stories when sharing the video, while others circulate it within family communication spaces as a mediated means of expression. In this way, the advertisement functions as a communicative intermediary, allowing emotions and viewpoints to be articulated through a shared reference and reducing the interpersonal risks associated with direct expression. The communicative effect of the campaign, therefore, depends not only on its textual design but also on how it is mobilized within everyday life.

From an international communication perspective, the campaign generates differentiated interpretive trajectories across cultural settings. Within China, it is commonly understood as a condensed reflection of family relations and social expectations. In overseas circulation, it may function as an entry point for observing Chinese gender culture within broader interpretive frameworks. The coexistence of these readings enables the narrative significance of the advertisement to be continually extended through cross-cultural circulation.

Taken together, audience-based narrative practices demonstrate that brand expressions around sensitive issues unfold within everyday social life rather than remaining confined to marketing discourse. Through emotional investment and ongoing narrative reproduction, SK-II's campaign achieved sustained visibility and public discussion. At the same time, this process illustrates how multinational brand narratives are received, negotiated, and reworked within local cultural contexts.

## 7. Conclusion

The communicative impact of SK-II's campaign suggests that when multinational brands engage with locally sensitive issues, their role lies less in offering solutions than in creating conditions under which experience can be seen and understood. Through documentary-style visuals and moderated narration, the advertisement constructs

a buffering space in which emotion is allowed to linger, enabling viewers to pause rather than arrive at immediate judgments. Marital pressure is neither reduced to an individual choice nor elevated to institutional critique, but presented as a perceptible condition situated between the two. By prioritizing recognizability over confrontation, the brand enters public discourse in a culturally legible manner.

At the same time, the meaning of the advertisement is not fixed by the brand, but continuously reorganized through circulation. Drawing on their own gendered experiences and family memories, audiences re-narrate and embed the campaign within lived contexts, transforming it into a medium for emotional expression and relational negotiation. This openness to audience reinterpretation allows the campaign to sustain visibility within the public sphere and indicates that the influence of brand narratives depends on their capacity to remain open rather than prescriptive.

More broadly, the SK-II case demonstrates that when brands engage with sensitive issues embedded in family ethics or gender structures, communicative value depends on preserving the complexity of social experience. Moderated articulation creates space for discussion amid tension, while audience re-narration highlights the importance of providing a discursive site where multiple voices can encounter and negotiate meaning. By locating expression at the intersection of cultural tension and social emotion, this study offers a grounded reference for understanding how multinational brands may develop sustainable strategies for engaging sensitive social discourse in contemporary China.

## Disclosure statement

The author declares no conflict of interest.

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# Analysis of Collaborative Elements in Temporary Teams Based on the Interview Method

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**Abstract:** As a primary organizational form in the flexible labor market and agile organizations, temporary teams have become a widely adopted team type. This study employed literature analysis and expert surveys to design the “Interview Outline for Research on Temporary Team Collaboration Mechanisms”, which was further optimized using AI tools to form the final interview protocol. Through purposive sampling, six interviewees with extensive experience in temporary teamwork were selected for pyramid-style in-depth interviews. The collaboration processes of temporary teams were examined from the perspectives of both team members and managers. The collected interview records were quantitatively analyzed, ultimately identifying five primary elements and 26 secondary elements in the collaboration process of temporary teams. The findings provide a reference for developing questionnaires in subsequent empirical research and offer insights for managers of temporary teams.

**Keywords:** Interview method; Temporary teams; Collaboration process; Quantitative analysis

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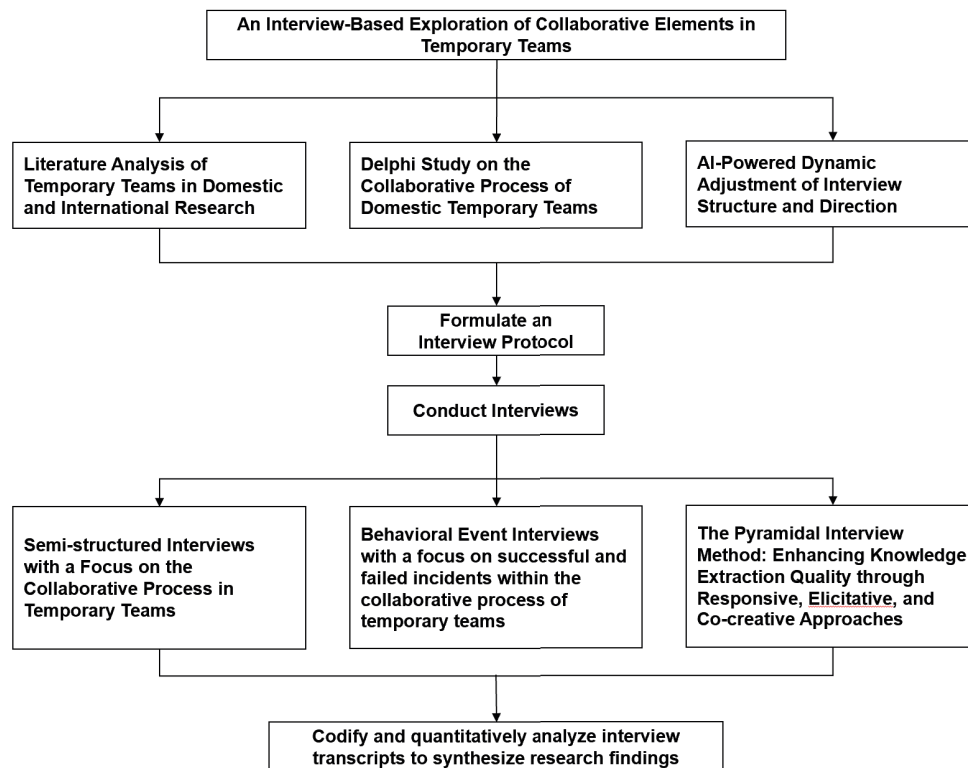
## 1. Introduction

According to statistics from QYResearch, the global flexible employment market is projected to reach \$3.9 trillion by 2025, with an annual compound growth rate of approximately 14%<sup>[1]</sup>. As the primary organizational form in the flexible employment market, the number of temporary teams has grown rapidly in recent years. Concurrently, the application scenarios of temporary teams have expanded. Both large-scale group corporations and small-to-medium-sized enterprises are increasingly adopting temporary teams to undertake tasks such as project development and technological innovation, aiming to adapt to complex and dynamic market environments and achieve agile management. Consequently, understanding the collaborative processes of temporary teams and optimizing their collaboration models has become particularly important. This paper primarily employs in-depth interviews with members of temporary teams to explore key stages and critical factors in the operation of such teams. The findings aim to support subsequent empirical research and provide recommendations for the management of temporary teams.



## 2. Research design

This study aims to comprehensively utilize methods such as literature analysis, the Delphi method, and AI-aided techniques to design an interview protocol. Semi-structured interviews, behavioral event interviews, and pyramid-style interviews were conducted to carry out in-depth interviews. The collected interview records were then systematically organized and quantitatively analyzed to extract key elements in the collaborative process of temporary teams. The findings are intended to support the construction of theoretical models and the design of questionnaires for subsequent empirical research. The specific research technical roadmap is illustrated in **Figure 1**.



**Figure 1.** Technical route of the research

### 2.1. Research methods and tools

In the process of designing the interview protocol, this study first developed a preliminary draft based on existing literature and research findings related to temporary teams, incorporating the STAR principle. The draft was then sent via email to experts in relevant research fields for consultation and feedback. Based on the experts' suggestions for revision, the interview protocol was further optimized using the AI tool Deepseek, ultimately forming the *Interview Protocol for Research on Temporary Team Collaboration Mechanisms*. The STAR principle is a commonly used method in behavioral event interviews, where:

S (Situation) refers to the specific context in which the event occurred,

T (Task) pertains to the tasks and what actually happened at the time, including how the interviewee addressed them,

A (Action) describes the actions taken by the interviewee in response to the situation, including their role and approach,

R (Result) focuses on the outcomes of the event <sup>[2]</sup>.

Interview questions designed following the STAR principle enable respondents to recall their behaviors and feelings during the event as accurately as possible, thereby enhancing the quality of knowledge extraction.

During the implementation of the interviews, this study conducted one-on-one online video interviews with respondents via Tencent Meeting. Tencent Meeting offers real-time transcription functionality, which automatically generates interview texts with high accuracy. Additionally, its built-in AI tools can simultaneously analyze ongoing interview content, helping interviewers identify gaps and adjust their questioning direction promptly, thereby further improving the comprehensiveness and systematicity of the interviews. During the interviews, the interviewer primarily adopted the pyramid-style interview strategy proposed by Wei Jun and He Yani. This strategy integrates three questioning approaches: responsive interviewing, stimulating guidance, and co-creative construction. Based on the interview protocol, semi-structured interviews and behavioral event interviews were conducted. The pyramid-style interview strategy is characterized by its goal of extracting comprehensive knowledge through multi-dimensional questioning, efficiently uncovering tacit knowledge. This approach effectively addresses challenges such as respondents' reluctance to share, interviewers' lack of expertise, and difficulties in judging the value of content, thereby enhancing the quality of knowledge extraction <sup>[3]</sup>.

In the process of organizing and analyzing interview records, this study primarily used the qualitative analysis software NVivo 12.0 to conduct word frequency statistics on the coded interview text data. This facilitated the extraction of key elements in the collaborative process of temporary teams and supported the drawing of conclusions.

## 2.2. Research sample

The research subjects of this study are members of project-based temporary teams. Considering the representativeness of the subjects and the operational feasibility of the research, a purposive sampling method—commonly used in qualitative research—was adopted for sample selection. This method involves selecting research subjects who can provide the most information relevant to the research questions based on the study's objectives <sup>[4]</sup>. A total of six participants were selected for in-depth interviews. **Table 1** provides the basic information about the interviewees.

**Table 1.** Basic information of the interviewees

No.	Sample ID	Gender	Age	Education	City	Years of Work Experience	Temporary Team Work Experience (Years)	Role/Tasks Undertaken in the Team
1	A	Female	35	Master's Degree	Zhuhai	10	8	Temporary Team Manager, Project Management, Documentation
2	B	Male	38	Doctoral Degree	Wuhan	8	5	Data Analysis, Documentation
3	C	Female	30	Master's Degree	Shenzhen	4	3	Research Analysis, Management Consulting
4	D	Female	28	Bachelor's Degree	Beijing	5	5	Visual Design, Video Editing
5	E	Male	33	Master's Degree	Guangzhou	8	4	Project Management, Requirements Communication
6	F	Male	25	Bachelor's Degree	Shanghai	2	2	Visual Design

### 3. Research process

#### 3.1. Design of the interview protocol

Keywords such as “临时团队” (temporary teams), “temporary teams”, and “团队协作” (team collaboration) were searched on CNKI. A total of 75 Chinese and 43 foreign language literature sources were collected. Relevant literature was then reviewed and analyzed. Based on this analysis and incorporating the STAR principle from the behavioral event interview method, a draft interview protocol was designed. This draft was subsequently revised based on expert feedback and optimized using AI tools, resulting in the finalized *Interview Protocol for Research on Temporary Team Collaboration Mechanisms*. This protocol primarily consists of six sections: Pre-interview Introduction, Background and Formation of the Temporary Team, Collaboration Process and Interactions within the Temporary Team, Support and Challenges for the Temporary Team, Team Effectiveness and Reflection, and Closing Remarks. The structure is outlined in **Table 2**.

**Table 2.** Interview protocol for research on temporary team collaboration mechanisms

Module	Purpose	Specific Questions
<b>Part I: Pre-Interview Introduction</b>	To introduce oneself, explain the research purpose, obtain consent for recording, help the interviewee settle into the interview, and establish trust.	<p>Hello, I am conducting a study on collaborative elements within temporary teams. This interview aims to gain an in-depth understanding of your collaborative experience in a past temporary team, with the goal of identifying key factors for enhancing team effectiveness. The interview content will be kept strictly confidential and used solely for academic purposes.</p> <p>This interview is expected to take 60-100 minutes. To facilitate subsequent analysis, I would like to audio-record our conversation and will also take notes. Do you consent to this?</p> <p>First, please briefly recall a recent temporary team you participated in that left a strong impression on you (e.g., a short-term project group, an emergency response team, a cross-departmental task force, etc.). We will use this team as a specific case for our discussion.</p>
<b>Part II: Background and Formation of the Temporary Team</b>	To understand the basic context, objectives, and composition of the temporary team, establishing the interview backdrop.	<ol style="list-style-type: none"> <li>1. Please briefly describe the basic situation of this temporary team: What was the team's main task or objective? Approximately how many members were there? From which departments or backgrounds did the members come? What was the team's lifespan?</li> <li>2. How did you join this team? What role did you play within it?</li> <li>3. At the initial formation stage, was there a clear kick-off meeting or goal presentation? In your opinion, was the team's goal clear and consistent for all members?</li> </ol>
<b>Part III: Collaboration Process and Interactions within the Temporary Team</b>	To delve into the specific collaborative behaviors, communication methods, decision-making, and conflict resolution mechanisms during the team's operation.	<ol style="list-style-type: none"> <li>1. What were the primary communication methods within the team? (e.g., daily stand-ups, WeChat groups, email, project management tools, etc.)</li> <li>2. Did you find the flow of information within the team to be smooth? Were there information barriers or delays?</li> <li>3. Did team members proactively and promptly share work progress, encountered problems, and newly acquired knowledge?</li> <li>4. Were the roles and responsibilities of team members clearly defined? Were they assigned beforehand or did they evolve during the process?</li> <li>5. In a rapidly formed team, how did members quickly establish trust? What incidents facilitated or hindered the building of trust?</li> <li>6. How did the team typically make key decisions? (e.g., leader's decision, democratic voting, expert opinion-driven?)</li> <li>7. When disagreements arose, how did the team usually handle them? Could you provide a specific example?</li> <li>8. During collaboration, did any task-related or interpersonal conflicts occur? How did the team respond to and resolve them?</li> <li>9. Do you think the approach taken was effective?</li> </ol>
<b>Part IV: Support and Challenges for the Temporary Team</b>	To understand the internal and external factors influencing the team's collaboration, as well as its adaptability and response capabilities.	<ol style="list-style-type: none"> <li>1. Did the team receive sufficient time, budget, technical tools, and support from senior leadership?</li> <li>2. Which tools or resources do you think were most helpful for the team's collaboration?</li> <li>3. Looking back on the entire process, what do you consider was the biggest challenge the team faced? (e.g., unclear goals, time pressure, team integration, insufficient resources, remote collaboration, etc.)</li> <li>4. How did the team overcome these challenges?</li> <li>5. Did the team have a clear leader or coordinator? What role did he/she primarily play?</li> <li>6. In your opinion, what constitutes effective leadership within a temporary team?</li> </ol>

**Table 2 (Continued)**

Module	Purpose	Specific Questions
<b>Part V: Team Effectiveness and Reflection</b>	To assess the final outcomes of the temporary team and extract lessons learned and suggestions for improvement.	1. How do you evaluate the team's final outcome? (Were the preset goals achieved? What was the quality like?) 2. What was your single biggest personal takeaway from this experience? 3. Based on your firsthand experience, what do you believe are the three most critical elements for successful collaboration in a temporary team? 4. If you were to participate in a similar temporary team in the future, what changes would you make in your collaborative approach? Or, what suggestions do you have for the organization in forming temporary teams?
<b>Part VI: Interview Conclusion</b>	To ask follow-up questions based on the interviewee's responses and express gratitude.	1. Have I missed any details or perspectives that you consider very important? 2. Thank you very much for taking valuable time out of your busy schedule to share your insightful experiences. Your input is of great value to my research! Thank you again!

### 3.2. Formal interviews

Following the aforementioned *Interview Protocol for Research on Temporary Team Collaboration Mechanisms*, this study conducted one-on-one in-depth interviews with the six respondents via online video calls. The duration of each interview was generally controlled between 60 and 100 minutes. During the interviews, the sequence and wording of questions were flexibly adjusted based on the respondents' answers, with in-depth follow-up questions posed as needed. Upon completion of each interview, the content was promptly transcribed. The transcripts and notes were then compiled into written manuscripts in a timely manner to facilitate subsequent coding and analysis. Specific details of the interview data are presented in **Table 3** <sup>[5]</sup>.

**Table 3.** Statistics of interview data

No.	Sample ID	Gender	Transcript ID	Interview Duration (Minutes)	Transcript Word Count
1	A	Female	A-1	98	26,084
2	B	Male	B-2	84	22,169
3	C	Female	C-3	71	15,432
4	D	Female	D-4	88	22,359
5	E	Male	E-5	82	21,987
6	F	Male	F-6	62	15,688
<b>Total</b>				485	123,719

## 4. Research findings

The interviews totaled 485 minutes, yielding 123,700 words of transcribed textual data after transcription. The interview transcripts were imported into the qualitative coding software NVivo 12. Following a thematic coding paradigm, each transcript underwent a three-level coding process consisting of open coding, axial coding, and selective coding. A theoretical saturation test was subsequently conducted. Furthermore, NVivo 12.0 was utilized to perform word frequency analysis on the coded interview text data, calculating the frequency of words for each coding node <sup>[5]</sup>. The detailed results are presented in **Table 4** <sup>[6]</sup>.



**Table 4.** Keywords and total frequency statistics of collaborative elements in temporary teams

No.	Open Coding	Text Segments	References
1	Goal Clarity	16	92
2	Information Transparency	15	86
3	Role Clarity	14	83
4	Goal Achievement Level	14	81
5	Task Specificity	13	78
6	Communication Frequency	13	76
7	Communication Channel	12	73
8	Feedback Timeliness	12	71
9	Leadership	11	70
10	Decision-making Mechanism	11	68
11	Trust Building	11	66
12	Tools & Technology	11	65
13	Adaptability / Agility	10	62
14	Coordination Mechanism	10	59
15	Member Satisfaction	10	58
16	Psychological Safety	9	55
17	Conflict Management	9	51
18	Resource Support	8	48
19	Knowledge Sharing	8	45
20	Launch Effectiveness	7	42
21	Process Standardization	6	40
22	Cohesion	5	36
23	External Support	4	30
24	Mutual Assistance	4	27
25	Individual Growth	4	26
26	Team Efficacy	1	10

Finally, content analysis was employed to quantitatively summarize the interview content. Repetitive or semantically similar indicators were consolidated, resulting in the extraction of five dimensions (primary indicators): “Team Leadership”, “Team Communication”, “Transactive Memory System”, “Incentive Mechanism”, and “Team Trust”, along with 26 secondary elements, as illustrated in **Table 5** <sup>[7-9]</sup>.

**Table 5.** Classification of collaborative elements in temporary teams

Primary Dimension	Collaborative Elements
Team Leadership	Goal Clarity, Role Clarity, Goal Achievement Level, Task Specificity, Leadership, Decision-making Mechanism, Adaptability / Agility, Coordination Mechanism, Process Standardization, External Support
Team Communication	Information Transparency, Communication Frequency, Communication Channel, Feedback Timeliness, Tools & Technology, Conflict Management
Transactive Memory System	Knowledge Sharing, Resource Support, Launch Effectiveness
Incentive Mechanism	Member Satisfaction, Psychological Safety, Individual Growth, Team Efficacy
Team Trust	Trust Building, Cohesion, Mutual Assistance

## 5. Conclusion

This study finds that, compared to formal teams or virtual teams, temporary teams exhibit strong similarities in the division of team life cycle stages. However, their collaboration process possesses distinct characteristics that significantly differ from other team types, such as variations in the duration and relative importance of each life cycle stage<sup>[10–11]</sup>. For temporary teams, the team formation phase is particularly critical, as it directly impacts the smoothness of subsequent collaboration and the achievement of team objectives. Temporary teams also place higher demands on team leadership. Key managerial tasks, including rational role allocation, appropriate member selection, task clarification, fair incentive mechanisms, and external communication, primarily need to be accomplished during the team formation period<sup>[12–13]</sup>.

Based on in-depth interviews, this study systematically identifies and analyzes the elements of the collaboration process within temporary teams, providing a preliminary exploration of their collaboration mechanisms. Future research will involve developing a questionnaire based on the five primary and 26 secondary elements identified above, followed by empirical studies on the collaboration mechanisms of temporary teams. The aim is to offer practical recommendations for the effective management of such teams<sup>[14–15]</sup>.

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## Disclosure statement

The authors declare no conflict of interest.

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# Research on the Realization Mechanism of Digital Technology Empowering Rural Common Prosperity

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**Abstract:** Digital technology, as a core carrier of new-quality productive forces, has become a key engine for promoting rural revitalization and achieving common prosperity. Based on the perspective of the Marxist technical view and the practical requirements of rural common prosperity in China, this paper systematically analyzes the internal mechanism, practical dilemmas, and realization paths of digital technology empowering rural common prosperity. The study finds that digital technology empowers rural common prosperity through three mechanisms: optimizing resource allocation, promoting industrial upgrading, and innovating governance models. However, in the practical process, it faces multiple dilemmas such as inadequate digital infrastructure, insufficient talent supply, poor technology adaptation, and uneven benefit distribution. To address these problems, this paper proposes a targeted path system: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, and improving benefit linkage mechanisms. This study provides theoretical support and practical reference for digital technology to better empower rural common prosperity.

**Keywords:** Digital technology; Rural common prosperity; Empowerment mechanism; Practical dilemmas; Realization paths

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## 1. Introduction

Chinese modernization is the modernization of common prosperity for all people, and the most arduous and onerous task of promoting common prosperity lies in rural areas. The report of the 20th National Congress of the Communist Party of China clearly proposed to “comprehensively promote rural revitalization” and “solidly promote common prosperity”, closely linking rural development with the common prosperity strategy, pointing out the direction for rural construction in the new era<sup>[1-2]</sup>. With the in-depth penetration of the digital economy into all fields of the economy and society, digital technology, as a new production factor, is profoundly transforming

traditional production methods and development models, injecting new momentum into rural common prosperity. The process of digital technology empowering rural common prosperity is essentially a process of the dialectical unity of technical instrumental rationality and value rationality. It is necessary to give full play to the instrumental advantages of digital technology in optimizing resource allocation and improving production efficiency, and adhere to the people-centered value orientation to ensure that the dividends of digital development are shared by all farmers.

In recent years, China's digital rural construction has accelerated comprehensively. Digital technology has been increasingly widely used in agricultural production, rural e-commerce, and rural governance. A development pattern has initially taken shape where mobile phones have become "new farming tools", data has become "new agricultural materials", and live-streaming with goods has become "new farming activities". However, at the same time, in the process of digital technology empowering rural common prosperity, a series of deep-seated contradictions and problems have been exposed, such as the persistence of the digital divide, low digital literacy of farmers, a mismatch between technology application and actual rural needs, and imperfect benefit distribution mechanisms. These problems have severely restricted the effective transformation of digital dividends into the achievements of rural common prosperity.

Existing studies have mostly focused on the application scenarios of digital technology in rural areas and the superficial paths of technology empowerment, but there is still a need to deepen research on the internal mechanism, the deep-seated causes of practical dilemmas, and the systematic realization paths of digital technology empowering rural common prosperity. Based on this, this paper systematically sorts out the internal mechanism of digital technology empowering rural common prosperity, deeply analyzes its practical dilemmas and causes, and then constructs a systematic realization path, providing new theoretical ideas and practical plans for promoting rural common prosperity.

## **2. The internal mechanism of digital technology empowering rural common prosperity**

The empowerment of rural common prosperity by digital technology is a process of the dialectical unity of technological progress and social development. Its internal mechanism is reflected in three levels: the improvement of productive forces, the transformation of production relations, and the reshaping of the development pattern, which is highly consistent with Marxist theory on the dialectical relationship between productive forces and production relations, and between economic base and superstructure.

### **2.1. Optimizing the allocation of production factors to activate the endogenous dynamics of rural development**

Marxist productive forces theory holds that productive forces are the ultimate decisive force promoting social development, and technological progress is the core driving force for the development of productive forces<sup>[3]</sup>. Digital technology optimizes the three elements of productive forces: laborers, means of labor, and objects of labor, comprehensively activating the endogenous dynamics of rural development.

In terms of laborers, digital technology improves farmers' production skills and management capabilities through skills training and knowledge popularization, promoting the transformation of traditional farmers into new professional farmers and realizing the modernization of human capabilities. Relevant studies have shown that farmers who receive systematic digital skills training have an average income increase of 23% compared



with those who do not receive training, and their ability to resist market risks is significantly enhanced <sup>[4]</sup>. In terms of means of labor, the deep integration of the Internet of Things, big data, artificial intelligence and other technologies with agricultural production has spawned new production tools such as intelligent agricultural machinery, precision irrigation, and intelligent monitoring of diseases and insect pests, transforming agricultural production from “relying on the weather” to “making decisions based on understanding the weather”, which has greatly improved agricultural production efficiency and quality. In terms of objects of labor, digital technology realizes the maximization of resource utilization efficiency through the digital management and precise allocation of land, water resources, agricultural products, and other resources, promoting agricultural production to develop in the direction of refinement, intensification, and high efficiency.

## **2.2. Promoting industrial upgrading to reshape the rural economic development pattern**

Digital technology breaks through the limitations of traditional rural industries and promotes the integrated development of rural primary, secondary, and tertiary industries, reshaping the rural economic development pattern <sup>[5]</sup>. Firstly, digital technology promotes the digital transformation of agriculture. Through the application of technologies such as satellite remote sensing, soil sensors, and crop growth monitoring systems, it realizes precise sowing, fertilization, and irrigation, improving agricultural production efficiency and product quality. Secondly, digital technology promotes the integrated development of rural industries. Relying on digital platforms, it connects agriculture with e-commerce, cultural tourism, health care, and other industries, developing new formats such as rural e-commerce, digital cultural tourism, and live-streaming with agricultural products, extending the industrial chain, and increasing added value. For example, rural e-commerce has effectively solved the problem of difficult sales of agricultural products, enabling farmers to directly connect with the market and obtain more value-added benefits. Thirdly, digital technology promotes the clustering development of rural industries. With digital technology as the support, it cultivates digital industrial clusters in rural areas, promotes the coordinated development of small farmers, cooperatives, and enterprises, forming scale effects and cluster advantages.

## **2.3. Innovating rural governance models to improve the modernization level of rural governance**

Digital technology provides a new technical path for innovating rural governance models and improving the modernization level of rural governance. Firstly, digital technology promotes the precision of rural governance. Through the construction of digital governance platforms, it realizes the collection, analysis, and application of rural governance data, providing precise support for rural governance decisions. For example, the application of digital technology in rural public security management can realize real-time monitoring and early warning of public security incidents, improving the efficiency of public security governance. Secondly, digital technology promotes the democratization of rural governance. Through digital platforms such as WeChat groups and rural governance apps, it broadens the channels for farmers to participate in governance, ensures farmers’ right to know, participate, and make decisions, and enhances farmers’ sense of gain, happiness, and security. Thirdly, digital technology promotes the equalization of rural public services. Through digital education, digital medical care, and other means, it enables rural residents to enjoy the same level of public services as urban residents, narrowing the development gap between urban and rural areas.

### **3. The dilemmas of digital technology empowering rural common prosperity**

Although digital technology provides strong technical support for rural common prosperity, in the process of practical promotion, due to multiple constraints such as the rural development foundation, technology application environment, and institutional guarantee system, the empowerment efficiency of digital technology has not been fully released, facing multiple practical dilemmas.

#### **3.1. Weak digital infrastructure: The “hard bottleneck” of digital empowerment**

Digital infrastructure is the prerequisite for the application of digital technology, but there are still obvious shortcomings in the construction of rural digital infrastructure. In terms of network coverage, although China has achieved “broadband access to every village” in administrative villages, remote mountainous areas still have problems such as unstable signals, slow broadband speed, and insufficient computing power, and there are even network blind spots in some areas, which cannot meet the network needs of new formats such as smart agriculture and rural e-commerce. In terms of hardware configuration, the popularization rate of smart terminals, Internet of Things equipment, and other hardware facilities in rural areas is low, and the purchase cost of equipment is high, which ordinary farmers cannot afford, restricting the application of digital technology in agricultural production and life services. In terms of data support, the construction of infrastructure for data collection, storage, and analysis in rural areas is lagging behind, and agricultural-related data is scattered across different departments and subjects, resulting in a serious “data island” phenomenon, which makes it difficult to form a joint force of data to support rural development decisions.

#### **3.2. Insufficient talent supply: The “soft constraint” of technology implementation**

Talents are the core support for digital technology to empower rural common prosperity, but the problem of talent shortage in rural areas is prominent, becoming a “soft constraint” restricting the implementation of digital technology. Firstly, the digital literacy of the local labor force is low<sup>[6]</sup>. The labor force left behind in rural areas is mostly older and less educated, with weak digital skills and literacy, insufficient awareness and acceptance of digital technology, and difficulty in proficiently using digital tools to carry out production and operation. For example, the participation rate of intelligent agricultural machinery operation training is less than 30%. Secondly, it is difficult to attract and retain compound talents<sup>[7]</sup>. Rural areas have relatively backward economic conditions and insufficient high-quality living supporting facilities, making it difficult to attract compound talents who understand both agriculture and technology. At the same time, a large number of young and middle-aged labor forces and high-quality talents in rural areas have flowed out, resulting in a shortage of local digital “leaders” and a lack of core support for the promotion and application of digital technology. Thirdly, the talent training system is imperfect. Digital skills training for farmers lacks systematicness and pertinence, and the training content is out of touch with the actual needs of rural production and life, making it difficult to effectively improve farmers’ digital application capabilities and form a virtuous cycle of “training-application-income increase.”

#### **3.3. Poor technology adaptation: The “blocking point” of supply-demand mismatch**

The value realization of digital technology must be adapted to the actual needs of rural areas, but there is an obvious mismatch between the supply of digital technology and the actual needs of rural areas, becoming a “blocking point” restricting the effect of digital empowerment. Firstly, the technical scenarios have poor adaptability. Mature intelligent algorithms and digital technologies in cities are difficult to adapt to the complex

and changeable natural conditions and decentralized production models in rural areas. Some equipment is complicated to operate, making farmers discouraged. At the same time, existing digital technologies mostly serve large-scale agricultural operations, and the supply of lightweight and low-cost digital tools suitable for small farmers is seriously insufficient. Secondly, the technology supply is “one-size-fits-all”. When promoting digital rural construction, some local governments ignore regional industrial characteristics and farmers’ actual needs, blindly introducing digital technologies and equipment, resulting in idle intelligent equipment and a low utilization rate of digital systems, forming a situation of “construction without use.” Thirdly, the value release of data elements is insufficient. A large amount of agricultural-related data is precipitated in different departments and enterprises, and there is a serious “data island” phenomenon, lacking a unified sharing and circulation mechanism, which cannot realize data integration and value mining, and is difficult to transform into productive forces and governance efficiency to promote rural development.

### **3.4. Uneven benefit distribution: The “obstruction point” of shared prosperity**

The core of common prosperity is the fair sharing of development achievements, but in the process of digital technology empowering rural development, the problem of uneven benefit distribution is prominent, becoming an “obstruction point” restricting shared prosperity. Firstly, farmers have low participation and voice. In the process of digital technology application, farmers are often in a passive acceptance position, lacking the right to speak and decision-making power in technology application and industrial development, and it is difficult to fully share the value-added benefits brought by digital technology. Secondly, the benefit linkage mechanism is imperfect. The benefit distribution of new formats such as rural e-commerce and agricultural product processing is mostly concentrated in intermediate links such as platform enterprises and dealers, and the proportion of benefits obtained by farmers is low. It is impossible to form a close benefit linkage mechanism of “enterprises + cooperatives + farmers” or “e-commerce platforms + farmers”, and it is impossible to realize risk sharing and benefit sharing. Thirdly, vulnerable groups are marginalized. The “digital divide” between urban and rural areas and between different groups in rural areas still exists. Vulnerable groups, such as the elderly and low-income groups, have difficulty enjoying the dividends brought by digital technology, and may even further widen the development gap with other groups due to digital transformation, violating the fairness principle of common prosperity.

## **4. The paths of digital technology empowering rural common prosperity**

To solve the practical dilemmas of digital technology empowering rural common prosperity, people must adhere to the core position of Marxist technical view, adhere to the people-centered value orientation, and build a systematic realization path from four dimensions: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, and improving benefit linkage mechanisms, so as to promote the deep integration of digital technology and rural development.

### **4.1. Consolidate digital infrastructure to lay a solid hardware foundation for digital empowerment**

Infrastructure is the premise for the application of digital technology. People must accelerate the improvement of the shortcomings of rural digital infrastructure to lay a solid hardware foundation for digital technology to empower rural common prosperity. Firstly, optimize the quality of network coverage. Increase investment in network construction in remote mountainous areas and underdeveloped areas, promote the extension of 5G

networks and gigabit optical fibers to rural areas, improve network speed and stability, eliminate network blind spots, and ensure that rural areas can meet the network needs of new formats such as smart agriculture and rural e-commerce. Secondly, improve the infrastructure operation and maintenance system. Establish a digital infrastructure operation and maintenance mechanism led by the government, participated by the market, and benefited by farmers, clarify the main responsibility of operation and maintenance, guarantee the investment of operation and maintenance funds, and promote the standardization of agricultural-related data to break “data islands” and realize the interconnection and data sharing of various information systems<sup>[8]</sup>. Thirdly, promote the popularization of hardware facilities. Increase policy support and financial subsidies for rural digital hardware facilities, encourage enterprises to develop smart terminals and Internet of Things equipment suitable for rural scenarios, simple to operate and low in price, improve the popularization rate of digital hardware facilities, and enable more farmers to use digital technology conveniently.

#### **4.2. Improve talent cultivation systems to strengthen talent support for digital empowerment**

Talents are the core elements of digital technology, empowering rural common prosperity. People must improve the rural digital talent cultivation system to provide solid talent support for digital empowerment. Firstly, improve the digital literacy of local farmers. According to the actual needs of rural labor forces, carry out systematic and targeted digital skills training, covering intelligent agricultural machinery operation, rural e-commerce operation, live-streaming with goods, etc., adopt a combination of online and offline training methods to improve the effectiveness of training, and promote the transformation of traditional farmers into new professional farmers. Secondly, increase the introduction of talents.

Formulate preferential policies to attract college graduates, returned entrepreneurial youth, urban technical talents, etc. to participate in rural construction, providing talent support for the application of digital technology in rural areas; at the same time, improve the incentive mechanism for rural talents, improve the treatment level and development space of rural talents, so that talents can stay and play their roles. Thirdly, cultivate local digital leaders. Select a group of rural backbones with culture, technology, and management capabilities for key training, making them leaders in the promotion and application of digital technology, giving play to their demonstration and leading roles, and driving more farmers to participate in digital technology application.

#### **4.3. Promote technology-scenario adaptation to improve the actual effect of digital empowerment**

The value realization of digital technology must match the actual needs of rural areas. People must promote the deep integration of digital technology with rural production and life scenarios to improve the actual effect of digital empowerment. Firstly, develop digital technologies suitable for rural areas. Encourage enterprises to conduct in-depth investigations in rural areas, develop lightweight, low-cost, and easy-to-operate digital technologies and tools according to the complex natural conditions, decentralized production models, and diversified needs in rural areas, to meet the different needs of small farmers and new agricultural business entities. Secondly, promote the deep integration of digital technology and industries. Based on the characteristics of rural industries, promote the deep integration of digital technology with agricultural production, rural e-commerce, rural tourism, and other industries, build a number of digital agricultural demonstration bases, rural e-commerce demonstration villages, etc., form replicable and promotable experience models, and promote the transformation and upgrading of rural



industries. Thirdly, strengthen the value mining of data elements. Establish and improve the sharing and circulation mechanism of agricultural-related data, break the data barriers between departments and enterprises, promote the integration and analysis of agricultural-related data, transform data resources into productive forces to promote rural development, and provide precise support for agricultural production and rural governance.

#### **4.4. Improve benefit linkage mechanisms to realize the fair sharing of development achievements**

The core of common prosperity is the fair sharing of development achievements. People must improve the benefit linkage mechanism of digital technology, empowering rural development, to ensure that digital dividends can be shared by all farmers. Firstly, improve farmers' participation and voice. Establish and improve the decision-making mechanism for farmers to participate in digital technology application and industrial development, guarantee farmers' right to know, participate, and make decisions, so that farmers can actively participate in the process of digital technology empowering rural development. Secondly, build a close benefit linkage mechanism. Promote the development of models such as "enterprises + cooperatives + farmers" and "digital platforms + farmers", establish a fair and reasonable benefit distribution mechanism, clarify the rights and obligations of all parties, enable farmers to share more value-added benefits brought by digital technology, and realize risk sharing and benefit sharing. Thirdly, pay attention to the development needs of vulnerable groups<sup>[9]</sup>. For vulnerable groups such as the elderly and low-income groups, formulate special support policies, carry out targeted digital skills training, provide aging-friendly and low-cost digital services, help them cross the digital divide, share the development dividends brought by digital technology, and ensure that no one is left behind on the road to common prosperity.

### **5. Conclusion and prospect**

Digital technology, as a core carrier of new-quality productive forces, provides strong technical support and practical possibilities for solving rural development bottlenecks and promoting rural common prosperity. From the perspective of the Marxist technical view, the process of digital technology empowering rural common prosperity is essentially a process of the dialectical unity of technical instrumental rationality and value rationality. It is necessary to give full play to the instrumental advantages of digital technology in improving productive forces and optimizing resource allocation, and adhere to the people-centered value orientation to ensure that digital dividends are shared by all farmers.

At present, digital technology empowering rural common prosperity faces multiple practical dilemmas, such as weak digital infrastructure, insufficient talent supply, poor technology adaptation, and uneven benefit distribution. These dilemmas are intertwined, restricting the effective transformation of digital dividends into the achievements of rural common prosperity. To solve these dilemmas, people must be based on the actual needs of rural development, build a systematic realization path from four dimensions: consolidating digital infrastructure, improving talent cultivation systems, promoting technology-scenario adaptation, improving benefit linkage mechanisms, and promoting the deep integration of digital technology and rural development<sup>[10]</sup>.

Looking forward to the future, with the continuous development of new technologies such as artificial intelligence and the metaverse, digital technology empowering rural common prosperity will usher in new opportunities and challenges. Next, people should continue to deepen the integrated development of digital



technology with rural industries, governance, culture, and other fields, continuously improve the institutional system and policy guarantee for digital rural construction, promote digital technology to better serve rural common prosperity, and lay a solid foundation for building a modern socialist country in an all-round way.

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## Disclosure statement

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# A Study on the English Translation Strategies for *the Contracts Volume of the Civil Code* from the Perspective of Relevance Theory

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**Abstract:** With the globalization of the Chinese economy and the promotion of the Belt and Road initiative, the demand for English translations of legal texts is growing. As a representative document of China's legal system, the English translation quality of *the Civil Code of the People's Republic of China* directly affects international legal exchanges. The discussion is over the translation strategies of *the Contracts Volume of the Civil Code* from the viewpoint of relevant theory in this paper, and the strategy for translating terms through the cognitive principle, communicative principle, and the difference between the maximum principle and the optimal principle in its English version, making legal texts translation have higher quality and communicative effects.

**Keywords:** Relevance Theory; *The Contracts Volume of the Civil Code*; English translation; Translation strategy; Legal text

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## 1. Background

Amid China's economic globalization and the Belt and Road Initiative, the demand for English translations of Chinese legal texts is rising, yet legal translation faces professional challenges like precise lexical equivalence. Sperber and Wilson's Relevance Theory provides a new solution by advocating optimal relevance between source information and the target readers' cognitive context. The English translation quality of the *Civil Code's Contracts Volume*, a core part of China's legal system, affects international legal exchanges. This thesis analyzes its Chinese-English versions from the Relevance Theory perspective to improve legal translation quality.

## 2. An overview of Relevance Theory

Proposed by Sperber and Wilson, Relevance Theory posits that human communication is essentially an ostensive-

inferential process<sup>[1]</sup>. Guided by the economic principle, communication relies on “relevance” as the sole standard for understanding, eliminating multiple interpretations. This theory is particularly pivotal for legal English translation, a field demanding extreme precision and strict fidelity to legal intentions, as it provides a targeted theoretical framework for bridging the cognitive and cultural gaps between Chinese and English legal texts.

Its core, the “principle of optimal relevance”, assumes all communicative acts are optimally relevant and requires minimizing cognitive effort to achieve maximum contextual effect—an imperative for legal translation, where misinterpretation risks distorting legal meanings. In legal translation practice, the theory guides translators to first infer the source text’s legal intentions based on the original cognitive context, then convey these intentions in a way aligned with target readers’ cognitive habits<sup>[2]</sup>. This paper adopts the theory’s interrelated cognitive, communicative, and strategic framework to study *the Contracts Volume*’s English translation. Notably, the theory’s distinction between “maximum relevance” (greatest effect with least effort) and “optimal relevance” (a balance between the two) directly addresses legal translation challenges, such as lacking equivalent terms across differing legal and cultural backgrounds<sup>[3]</sup>. This framework enables systematic analysis of translation problems, ensuring translators select expressions with equivalent legal communicative effects, thereby enhancing the accuracy and validity of legal English translations.

### **3. Chinese and English language characteristics of the contracts volume**

#### **3.1. At the syntactic level**

The relevance theory emphasizes that translation should establish the best connection between the source language information and the target reader’s cognitive context. The differences in sentence structures directly affect the balance between cognitive effort and contextual effect. The characteristics of *the Contracts Volume* in both Chinese and English at the sentence level essentially reflect the legal thinking and expression habits of China and the UK. In the Chinese sentence level, to achieve rigorous expression, long sentences with nested attributive and adverbial clauses are often used. The logical relationship does not rely on explicit conjunctions but is naturally presented through word order and semantics. Chinese legal texts often adopt the active voice, with the subject being “parties”, “law”, “the state”, etc., directly highlighting the authority of legislation and the responsibility of the subject. The expression is straightforward and powerful, and tends to break down complex information into coherent short sentence chains, connected by words such as “and” and “according to”, ensuring the completeness of the content while reducing the cognitive burden of the readers, demonstrating the flexibility of semantic expression.

Additionally, English leans towards employing more nouns compared to Chinese, necessitating adjustments in sentence structure during the English translation of Chinese legislative texts<sup>[4]</sup>. The English sentence level focuses on the explicitation of logic, using explicit logical conjunctions, such as where, if, unless, attributive clauses, and adverbial clauses to clearly define the relationship between sentences, externalizing the implicit semantic logic of Chinese. English widely adopts the passive voice to weaken the actor of the action, emphasizing the object of the behavior and the objectivity of legal rules. For multiple obligations or provisions, English uses parallel sentence structures with consistent structure, connecting core predicate components with “and”, making the grammar symmetrical and the logic clear, conforming to the regularity of English legal text form, and using “shall” as the core modal verb to express legal mandatory nature, paired with “shall not”, “may”, etc., clearly distinguishing obligatory, prohibitive and authorizing rules, avoiding semantic ambiguity.

### 3.2. At the lexical level

From the perspective of the correlation theory, the language characteristics of *the Contracts Volume* in Chinese and English at the lexical level mainly aim to adapt to the legal cultures of China and England and the cognitive contexts of the readers, achieving the optimal relevance through vocabulary selection-accurately conveying the legislative intent while reducing the cognitive effort of the target readers. The lexical level of the Chinese language pays more attention to conciseness and dynamic expression, often using simple two-word or four-word terms to carry the core legal connotations, such as “force majeure” and “joint liability”, to summarize complex legal concepts in a highly condensed form, which conforms to the cognitive logic of Chinese legal terms “pre-defined name, then explanation.” Readers need to supplement the attributive or subsequent explanations based on the context to fully grasp the boundary of the concept. At the same time, in Chinese legal vocabulary, “The principle of uniformity is particularly important, because the accuracy, authority, and seriousness of legal language determine that legal terms must be consistent in the context of the same legal text, and be responsive”<sup>[5]</sup>.

The lexical level of English is characterized by an analytical nature and static abstraction. Legal terms often clarify the boundaries of concepts through phrase combinations, suffix changes, or loanwords such as force majeure derived from French, avoiding ambiguity, and emphasizing the consistency of the terms in the text to ensure the accuracy of cross-cultural communication. Lexical combinations are centered on nouns, and Chinese verb phrases are often transformed into noun phrases through nounization to abstract and conceptualize the behavior, which conforms to the characteristics of English legal texts that emphasize formality and generalization. In addition, English relies on the core modal verb “shall” to define the mandatory nature of legal rules, combining “shall not”, “may”, etc., to clearly define the semantic levels of obligations, prohibitions, and authorizations.

This difference at the lexical level essentially reflects the manifestation of legal culture and cognitive habits. The conciseness and dynamism of Chinese vocabulary stem from the comprehensive thinking of the Chinese legal system, while the analytical nature and static nature of English vocabulary align with the emphasis on precise concepts and formal logic in the Anglo-American legal system. From the perspective of correlation theory, translators need to establish compatibility between the two lexical systems through strategies such as standardization of terminology, semantic supplementation, and conversion of parts of speech: for international common terms like “不可抗力”, direct adoption of “force majeure” achieves cognitive correlation. “Force majeure” is the most accurate, professional, and normative translation. To avoid ambiguity caused by different places of comprehension, the domestication strategy is used<sup>[6]</sup>.

## 4. Analysis of the English translation strategies for the contracts volume from the perspective of Relevance Theory

### 4.1. Context and cognitive environment

From the perspective of context, under the framework of the association theory, context is regarded as a dynamic cognitive construct, encompassing linguistic context, situational context, and cultural context. The translation strategies need to be adapted to the different contextual features at various levels. In the language context, the logical rigor of legal texts requires that terms maintain a high degree of consistency. The legal context of the source language has distinct characteristics of the Chinese legal system. Its conceptual framework, logical structure, and value orientation are all rooted in the historical evolution and current framework of China’s civil legal system. In the process of English translation, the first step is to accurately identify the core elements of the source language context, including the connotations and boundaries of specific legal concepts, the logical

connections between provisions, and the value orientation of the institutional design. On this basis, the translator needs to project these elements into the legal context of the target language and ensure that the translation has legal semantic reference and logical consistency in the target language context through means such as term selection and sentence restructuring. To achieve the optimal relevance, the translator must make sure that when translating the work into another language, the translated text makes it convenient for the target audience to infer the context appropriately, highlight certain parts when necessary, and not cause contradictions that will impede understanding. Adapting the translation to the readers' cognitive world so as to make it comprehensible without losing the original sense [7].

From the perspective of cognitive environment, "when people are communicating, they will share part of each other's cognitive environment, thus evolving into a shared cognitive context, in which every explicit assumption is a shared extensive behavior" [8]. There are systematic differences in legal cognitive backgrounds between Chinese and English readers. The target language readers' cognitive environment is based on what they know about the legal system, concepts, and ways of thinking. Legal concepts in the source language can be quite different, often coming from the unique legal history and concrete systems in China. Therefore, the translation strategy needs to actively adapt to this cognitive difference; for content that has conceptual gaps or significant differences in the target language's cognitive environment, adjust the information presentation form through semantic supplementation, logical reconstruction, etc., to help readers gradually build new cognitive nodes based on their own cognitive foundation, ultimately achieving an effective connection between the source language and target language cognitive environments, ensuring the accuracy of the translation while also having an acceptable cognitive accessibility.

#### Example 1:

SL: 第五百二十五条 “当事人互负债务, 没有先后履行顺序的, 应当同时履行. 一方在对方履行之前有权拒绝其履行要求. 一方在对方履行债务不符合约定时, 有权拒绝其相应的履行要求.”

TL: “Where both parties have obligations toward one another and there is no order of priority in respect of the performance of obligations, the parties shall perform the obligations simultaneously. Each party has the right to reject any demand by the other party for performance prior to the performance by the other party. If the performance of the obligations of the party who is to perform first is not in conformity with the agreement, the party who is perform later has the right to reject the other party's demand for corresponding performance.”

The explicit institutional connotation approach is applied to adapt to the cognitive context of the Anglo-American legal system. In the original Chinese, “同时履行” is a term from the civil law system, and there is no exact equivalent concept in the Anglo-American legal system. The translation does not directly translate the term but uses a conditional clause introduced by where to explicitly present the applicable scenarios of the institution that the parties have mutual debts, and there is no order of performance, and then uses perform simultaneously to clearly define the core action, converting the abstract right into a concrete expression of scenario and action. This strategy avoids misunderstandings by the target language readers due to the lack of institutional context, ensuring the accurate transmission of legal connotations in different legal system contexts.

## 4.2. Ostensive-inferential communication

Communication is a process in which the speaker conveys the intention of information through explicit actions,



and the listener infers based on the context assumptions to obtain the communicative intention. The English translation of the Contracts Volume, as a cross-cultural legal communication behavior, needs to optimize the explicit information and guide the readers of the target language to infer the path, in order to accurately convey the legal intention.

From the standpoint of ostensive, the translator is required to translate the core information of texts of the source language law into explicit signals that can be recognized by the receivers and readers of the target language. The core elements of legal provisions constitute the core of explicit content. The translator must make sure that these components are discernible via word choice and sentence structure adjustments. “But, having a correct understanding of these terms can be achieved via reasoning and inferring with regard to context. This process of inferences can be based on legal principles, case laws, legal interpretation, and some kind of logical reasoning to find the meanings and application of the specific term”<sup>[9]</sup>.

At the inferential level, the translator needs to predict the readers’ contextual assumptions in the target language and adjust the way information is presented to guide them in constructing a correct reasoning chain. The differences between the Chinese and English legal systems may cause readers to have different contextual associations for the same concept. The translator needs to limit the readers’ reasoning direction through the structured arrangement of explicit information. The translator can adjust the sentence order, use logical connectives, etc., to guide readers to reason according to the internal connection of legal logic, ensuring that they can deduce the legal consequences consistent with the source language from the explicit information.

#### Example 2:

SL: 第四百九十八条 “对格式条款的理解发生争议的,应当按照通常理解予以解释.对格式条款有两种以上解释的,应当作出不利于提供格式条款一方的解释.格式条款和非格式条款不一致的,应当采用非格式条款.”

TL: “If a dispute over the understanding of standard terms occurs, interpretation shall be made in accordance with common understanding. Where there are two or more kinds of interpretation, an interpretation unfavorable to the party furnishing the standard terms shall prevail. Where the standard terms are inconsistent with non-standard terms, the latter shall prevail.”

The word “shall” appears three times in the text, all indicating mandatory legal requirements. However, the Chinese word “应该” naturally distinguishes its applicable scenarios through semantics in different contexts. In English legal texts, “shall” can represent obligations, but repeating it multiple times can be monotonous. Moreover, it needs to be strengthened through syntactic structures to clarify the logical relationship. The translator adopts a conversion translation method, translating the first two “shall” as “interpretation shall be” and “an interpretation... shall”, and the third “shall” as “the non-standard term the latter shall prevail.” By changing the subject from understanding the format clause and interpreting the format clause to “the interpretation”, “the non-standard term”, the core action of each sentence is made more prominent.

Meanwhile, the conditional clause “对格式条款的理解发生争议的” was transformed into an “if” conditional clause in English, clearly establishing the logical relationship. This conversion not only retained the core explicit information of the mandatory interpretation rule but also made the translation conform to the syntactic habits of English legal texts, helping readers quickly infer the three major principles for interpreting the standard terms.

### 4.3. Relevance and optimal relevance

The maximum relevance refers to the situation where the audience can obtain the maximum contextual effect with the least cognitive effort. The optimal relevance, on the other hand, requires the audience to make a reasonable cognitive effort and then obtain sufficient contextual effect. The English translation of *the Contracts Volume* needs to strike a balance between these two relevance: avoiding information distortion caused by excessive pursuit of “minimum cognitive effort” that is pure maximum relevance, and preventing the burden on readers due to excessive information redundancy that is deviating from optimal relevance. “In practical communication, speakers cannot and will not go to great lengths to maximize “ostension” for the benefit of the listener’s understanding, and listeners, likewise, do not mobilize their entire “cognitive context” to decipher the speaker’s intentions in the interest of effective communication”<sup>[10]</sup>. At maximum relevance, the translator must fully consider the cognitive habits and legal knowledge reserves of the target language readers. By simplifying redundant information and using expressions that conform to the norms of English legal texts, the translator can reduce the readers’ comprehension costs.

To achieve optimal relevance, the translation should construct in the target language a contextual effect that is similar to that the readers of the translation would get when they read the source language text in its legal context. “Communication occurs because people instinctively stick with the principle of appropriateness, where they intuitively want to conduct effective exchanges by making as much of what is communicated relevant as possible”<sup>[11]</sup>. This means that translation cannot give up on accurate transmission of legal information for the sake of cognitive convenience. As to legal concepts or systems with Chinese characteristics, semantic supplementation and logical reinforcement methods should be adopted so that the readers of the target language can understand the special connotation of these concepts and systems in their own cognition.

Example 3:

SL: 第五百四十三条 “当事人协商一致,可以变更合同.”

TL: “A contract may be modified if the parties reach a consensus through consultation.”

The core term “alter the contract” in the Chinese legal context clearly refers to the modification of the contract content. In English legal texts, “modify a contract” is the standard term for expressing modifying the contract content, while change a contract is more focused on the overall state change of the contract and is prone to ambiguity. The translator adopts term correspondence conversion, translating “变更合同” as “a contract may be modified”, and “协商一致” for “reach a consensus through consultation”, precisely corresponding to the connotation of reach a consensus through consultation. The translation uses equivalent term mapping, enabling English readers, especially legal practitioners, to directly associate with the contract modification rules in their cognition without additional reasoning about the term’s meaning, while the choice of “modify” ensures the precision of the legal concept.

## 5. Conclusion

The paper studies Relevance Theory to translate English-Chinese legal terms from the perspectives of relevant context, ostensive inferential model, optimal relevance, and interpretative resemblance. Applying this theory to *the Contracts Volume* English translation, there is double benefit, on the theoretical side, it adds cognitive and

communicative perspectives to the Chinese legal translation research scope and offers a more comprehensive framework to study legal translation rules and complex theories, on the practical side, in global business situation, correct interpretation of *the Contracts Volume* will make it much easier for foreign parties to engage in cross boundary transactions and avoid misunderstanding.

Firstly, Relevance theory is a good theory for legal translation. Legal translation is not linguistic translation; it requires cognitive context conversion in cross-cultural communication. Translators have to take legal system differences and the target reader's habits into account and still maintain legislative intent. The ostensive-inferential model, plus the difference between max, optimal relevance, steers people in handling the basic problems of term-equality, logic, and cultural-adaptation.

Second, in terms of ostensive-inferential, contract translation expresses the legal intention by making explicit information as precise as possible and prompting inference. As for translators converting source essentials into recognizable signals through exact words and sentences adjustments, for Chinese-related legal ideas, use equivalent target terms for reader's reduced labor. Inferential-translators assume the target reader's assumptions, taking into account the differences between the Chinese-English legal systems and structuring information to inform the target readers' legal-logic reasoning so as to provide consistent legal consequences as the source.

Thirdly, translation depends on the maximum and optimal relevance principles. Legal information transmission strikes a balance between the two to make them work. Maximum relevance requires minimum cognitive effort, eliminates redundancy, uses simple standard English legal terms; adopt mature target terms for foreign concepts. Optimal relevance has to be aligned with the source legal context, and building up consistent contextual effects, but without sacrificing accuracy for the sake of convenience, and supplemented in semantics and logic for those special ideas, so they could be understood

Finally, research suggestions for future work: Expand the corpora to compare contract English translations into other languages, extend to different legal texts; Conduct an empirical research survey of non-Chinese speaking foreign legal business people on their understandings of these translations to gauge the effectiveness of the strategies.

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# A Study on Translation Norms for Overseas Clinical Case Records of HUANGs' School of Acupuncture and Moxibustion of Zhuang Medicine in Guangxi

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**Abstract:** With the development of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in clinical practice and international exchange, the number of overseas patients has gradually increased, and the translation of overseas clinical case records faces risks of semantic shift and dilution of medical connotations in cross-cultural contexts. Taking overseas clinical case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi as the primary object of analysis, this study employs methods including textual analysis of case records, structural comparison, and terminology categorization to systematically examine their structural and terminological characteristics as well as key issues arising in translation. The study reveals significant differences between Zhuang medicine case records and Western medical records in terms of narrative structure, disease cognition, and cultural context. From the perspectives of structural translation and terminological translation, this paper proposes a normative framework that balances the preservation of Zhuang medicine characteristics with the needs of cross-cultural understanding. This framework includes hierarchical presentation of case record components, functional interpretation of disease names and acupuncture terminology, and process-oriented supplementation of therapeutic effect descriptions. The aim is to enhance the accuracy and usability of case records in international communication and academic dissemination, and to provide references for the standardized organization and database construction of Zhuang medicine clinical case records.

**Keywords:** Clinical case record translation; Zhuang medicine; Terminology standardization; Structural standardization; HUANGs' school of acupuncture and moxibustion of Zhuang medicine

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## 1. Introduction

Under the promotion of the Belt and Road Initiative and policies encouraging traditional Chinese medicine



and ethnic medicine to “go global”, Zhuang medicine acupuncture and moxibustion have gradually attracted attention and recognition from overseas populations. With the deepening of clinical exchanges, the number of overseas patients receiving Zhuang medicine acupuncture and moxibustion treatment has steadily increased, leading to a growing body of overseas clinical case records. The disease names, therapeutic principles, and technical descriptions used in Zhuang medicine acupuncture and moxibustion case records are deeply rooted in the knowledge system of traditional Zhuang medicine, and their narrative styles and conceptual connotations differ markedly from those of modern Western medicine in terms of disease classification and case record writing norms. When such case records are used for international communication, academic dissemination, or database construction, they must be translated and presented across different languages and medical-cultural contexts. In the absence of unified translation norms, misunderstandings of medical information may easily arise, weakening the integrity of Zhuang medicine acupuncture and moxibustion’s diagnostic and therapeutic concepts. Therefore, how to standardize the translation of overseas patient case records while preserving the academic connotations and distinctive features of Zhuang medicine acupuncture and moxibustion, and how to normalize case record data to ensure accuracy and usability, have become pressing issues in the organization and utilization of Zhuang medicine case record databases. The HUANGs’ school of acupuncture and moxibustion of Zhuang medicine in Guangxi was founded by Master of Traditional Chinese Medicine Huang Jinming, based on theories such as Yin-Yang theory, three channels and two ways theory, and the three Qi Synchronization of heaven, earth, and man theory. This study takes overseas patient case records generated in domestic clinical practice of Guangxi HUANGs’ Zhuang medicine acupuncture and moxibustion—represented by cases involving British patients—as its research object. These records comprehensively document patient background information, chief complaints, medical history, diagnosis, and acupuncture treatment processes, and thus possess high textual integrity and research value.

## 2. Literature review

Clinical case records are systematic records of medical activities carried out by healthcare professionals during the occurrence, development, and outcome of a patient’s illness, including examination, diagnosis, and treatment <sup>[1]</sup>. They constitute an important basis for clinical practice, as well as a core text for medical knowledge transmission and medical quality control. With the evolution of medical forms and healthcare systems, the terminology used to refer to case records has continuously changed—such as medical cases, medical records, and clinical case records—reflecting not only changes in medical writing forms but also shifts in physicians’ emphases and research perspectives in different historical periods <sup>[2]</sup>.

In modern medical research, scholarly attention to clinical case records has primarily focused on the establishment of electronic medical record standards, optimization of case record management models, and construction of quality control systems <sup>[3–5]</sup>. In addition, some studies have begun to address case record texts in specific ethnic medical fields, such as explorations of quality standards and management systems for Zhuang medicine case records, which provide important references for the standardization of ethnic medicine case records <sup>[6]</sup>. However, research from the perspective of case record writing itself remains relatively weak. Some scholars, after analyzing a large number of medical journal manuscripts, have pointed out that many journals lack adequate requirements for case report writing, or even exhibit clear deficiencies, resulting in uneven overall quality <sup>[7]</sup>. Common problems in case record writing include insufficient authenticity, incomplete data, and non-standardized recording <sup>[8]</sup>. In particular, in clinical practice, some patients are hospitalized due to abnormal

laboratory or imaging findings without clear subjective symptoms or signs. Since existing case record norms generally prohibit directly listing examination results as chief complaints, clinicians are sometimes compelled to fabricate symptoms or signs that do not actually exist, thereby further undermining the authenticity and standardization of case records <sup>[9]</sup>.

Overall, existing research has laid a relatively solid theoretical foundation in areas such as digitization, standardization, quality standards, and management systems of case records. However, systematic studies that integrate structural differences in case records with cross-cultural translation norms, specifically targeting overseas Zhuang medicine acupuncture and moxibustion case records, remain clearly insufficient. Based on this gap, the present study takes overseas clinical case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi as its research object. Through comparative analysis of the structure and writing differences between domestic and foreign case records, it explores and proposes corresponding translation norms, with the aim of providing references for the international dissemination of ethnic medicine case records.

### **3. Textual characteristics of overseas clinical case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

#### **3.1. Basic composition of overseas case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

From an overall structural perspective, overseas clinical case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi exhibit a high degree of consistency with traditional Zhuang medicine clinical case records in terms of basic components. They typically include core elements such as general patient information, chief complaint, medical history, examinations, diagnosis, and treatment process, and can relatively comprehensively reflect the entire course of disease onset, development, and therapeutic outcome. In terms of patient information, the case records clearly document basic details such as nationality, gender, and age, while some information—such as occupation and place of residence—is recorded in a relatively simplified manner. At the diagnostic and therapeutic level, the records generally follow a narrative logic of chief complaint, medical history, examinations, diagnosis, and treatment process. Chief complaints directly reflect patients' discomforts; the medical history emphasizes symptom duration, aggravating or alleviating factors, and prior treatments; examinations are mainly based on clinical observation, often incorporating traditional diagnostic information such as tongue appearance and pulse condition; diagnoses center on Zhuang medicine disease names, supplemented by modern medical disease names for reference; and the treatment section, as the focal point of the case record, details acupuncture point selection, manipulation techniques, treatment frequency, and course arrangement.

#### **3.2. Differences between British medical records and Zhuang medicine case records**

First, British medical records emphasize standardization, normalization, and legal traceability. They are typically structured around modules such as chief complaint, history of present illness, past medical history, examination results, diagnosis, and treatment plan. The language is objective and concise, faithfully recording facts and decision-making bases to serve quality control and legal review. In contrast, Zhuang medicine case records adopt a more narrative structure, with diagnostic and therapeutic processes presented through consecutive records of initial, second, and third consultations, providing detailed descriptions of symptom evolution and therapeutic effects, and highlighting a clinical experience- and outcome-oriented approach.

Second, British medical records are based on the modern biomedical model, in which diseases are defined primarily by anatomical, physiological, or pathological abnormalities, with emphasis on objective examination results and evidence-based reasoning. Zhuang medicine case records, by contrast, are grounded in ethnic medical theory and employ concepts such as “Nen Bule (insomnia)” and “He Yin (low back pain),” understanding disease as manifestations of systemic imbalance. Diagnosis places strong emphasis on tongue appearance, pulse condition, and overall bodily perception.

Third, British medical records reflect Western societal values emphasizing systems, norms, rationality, and legal responsibility, whereas Zhuang medicine case records embody the cultural tradition of Chinese ethnic medicine, which values experience, holism, and the relationship between humans and nature. The differences between British medical records and Zhuang medicine case records thus represent not only divergences between medical systems, but also deeper contrasts in cultural context, cognitive patterns, and value systems.

## **4. Cultural context issues in the translation of overseas clinical case records of HUANGs’ school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

### **4.1. Differences between Western disease cognition and Zhuang medicine diagnostic thinking**

Zhuang medicine diagnosis and treatment are based on holistic perspectives and accumulated experience, emphasizing the internal balance of the human body. Treatment does not revolve around a single symptom, but rather gradually improves bodily states through repeated interventions, which is reflected in case records as continuous documentation of symptom evolution, treatment responses, and long-term effects. Western disease cognition, influenced by the modern biomedical model, tends to conceptualize disease as a specific, clearly defined pathological state. When case record texts are translated or presented internationally without explanation of this cognitive difference, readers may easily perceive Zhuang medicine treatment as merely experiential practice, thereby weakening the academic persuasiveness of the records. Consequently, translation of overseas case records must not only accurately present diagnostic and therapeutic facts, but also reflect the holistic and process-oriented nature of Zhuang medicine thinking at the structural and expressive levels, enabling readers in non-local contexts to understand the therapeutic logic rather than focusing solely on surface-level outcomes.

### **4.2. Cross-cultural interpretation of Zhuang medicine disease names and syndrome descriptions**

Disease names and syndrome terminology in Zhuang medicine case records often carry specific cultural connotations and medical experience, and their semantics do not fully correspond to categories in modern medical disease classification systems. While disease names have clear referential meanings in the original context, it is often difficult to find one-to-one equivalents in modern medical terminology during cross-linguistic translation. In existing overseas case records, some practitioners attempt to bridge understanding gaps by annotating both Zhuang medicine disease names and modern medical disease names. Although this approach can help readers form a preliminary understanding, the lack of a clear hierarchical distinction may still lead to misinterpretation—for example, perceiving Zhuang medicine disease names as direct equivalents of modern medical diagnoses or dismissing them as mere folk terms, thereby overlooking their underlying diagnostic systems. Similar issues arise with syndrome descriptions, which emphasize holistic pathological characteristics and trends rather than standardized indicators. When translated directly without contextual explanation, such descriptions may be

perceived as vague or subjective. Therefore, it is necessary in overseas case record translation to distinguish the functional attributes of disease names and syndromes and to employ appropriate explanatory expressions to avoid oversimplification or false equivalence.

### **4.3. Potential risks of misinterpretation in external dissemination of case records**

Once overseas case records are detached from their original clinical contexts and used for academic exchange, teaching examples, or database display, the information they carry becomes subject to reinterpretation. Without unified translation norms, multiple levels of misreading may occur.

First, experiential language may be misunderstood as a non-standard clinical recording. Common efficacy descriptions such as “significant improvement” or “symptoms basically resolved” have clear referential meanings in the local context, but may be perceived as lacking quantitative evidence in international dissemination, thereby affecting credibility.

Second, culturally implicit information is easily overlooked in translation. Holistic regulation strategies, staged treatment arrangements, and the significance of follow-up observation in Zhuang medicine acupuncture and moxibustion may be difficult for readers without a Zhuang medicine background to grasp if not explicitly explained.

Third, inconsistency in case record structure and terminology may lead to information distortion at the database application level. In multilingual or multidisciplinary contexts, structural and terminological discrepancies across case records can directly affect data organization, statistical analysis, and knowledge mining. Thus, translation issues in overseas case records are not merely linguistic problems, but are deeply rooted in medical cultural differences and functional transformation of texts, necessitating the construction of clear, unified, and culturally informed translation norms.

## **5. Structural translation norms for overseas clinical case records of HUANGs’ school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

### **5.1. Basic principles for structural translation of Zhuang medicine case records for overseas patients**

Structural translation of overseas case records should adhere to the following principles.

First, diagnostic and therapeutic facts must remain unchanged. The core of structural translation lies in optimizing information presentation, not in selecting or reconstructing content or medical judgments. Chief complaints, examination results, diagnostic conclusions, treatment methods, and therapeutic outcomes recorded in the case records must retain their original authenticity, avoiding interpretive deviations introduced by structural adjustments.

Second, medical terminology should be used in a standardized manner, including Zhuang medicine terminology, traditional Chinese medicine terminology, and Western medical terminology. Diagnoses should explicitly reflect Zhuang medicine diagnosis (disease name plus syndrome), traditional Chinese medicine diagnosis (disease name plus syndrome), and Western medical diagnosis. Whenever Zhuang medicine theory, prescriptions, or techniques are employed, the medical record must clearly reflect Zhuang medicine diagnostic methods, including the Five Diagnostic Methods, disease–syndrome differentiation, and the rationale for treatment.

Third, a balance should be maintained between preserving Zhuang medicine characteristics and meeting



cross-cultural comprehension needs. Structural translation does not aim at “Westernization”, but rather seeks to retain Zhuang medicine diagnostic thinking and technical features while adopting more widely recognized case record organizational forms, thereby lowering comprehension barriers and laying the foundation for subsequent terminological translation and database applications.

## **5.2. Recommended structural framework for overseas clinical case records of HUANGs’ school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

Based on the actual components of HUANGs’ Zhuang medicine acupuncture and moxibustion case records, and with reference to the standards for the clinical structure and content of patient records issued by the Health and Social Care Information Centre and the Academy of Medical Royal Colleges, as well as the Basic Norms for Writing Zhuang medicine Medical Records, this study proposes a recommended structural framework for translating overseas case records of HUANGs’ Zhuang medicine acupuncture and moxibustion<sup>[10–11]</sup>. This framework is not intended to replace existing writing practices but to serve as a reference for external presentation and standardized organization.

The first section is the patient’s basic information. In addition to existing information such as physiological sex, age, nationality, and consultation date, supplementary information should include gender (as the patient wishes to portray themselves) and ethnicity. As these are overseas case records, marital status and occupational information may be omitted.

The second section is the chief complaint. This should summarize the patient’s primary discomfort at the time of consultation. Language may be moderately standardized while remaining faithful to the original meaning, avoiding excessive colloquialism.

The third section is medical history. Past medical history should be presented chronologically, including Western medical diagnoses, surgical or trauma history, allergy history, medication history, and the onset and progression of the current condition, providing background for understanding treatment logic.

The fourth section is the examination. Diagnostic techniques, such as the Five Diagnostic Methods of Zhuang medicine, as well as the Four Diagnostic Methods of traditional Chinese medicine, should be supplemented. Existing clinical observations and necessary traditional diagnostic information, such as tongue appearance and pulse condition, may be described in relatively clear terms while preserving Zhuang medicine characteristics.

The fifth section is Zhuang medicine diagnosis, with diagnostic rationale explicitly stated. Zhuang medicine disease names or syndromes should serve as the core, with modern medical disease names added as references when necessary. Different diagnostic systems should be clearly distinguished structurally.

The sixth section is acupuncture treatment, with the treatment rationale supplemented. This section should systematically present acupuncture point selection, manipulation techniques, treatment frequency, and course arrangement, and constitutes a key module for demonstrating the characteristics of HUANGs’ Zhuang medicine acupuncture and moxibustion.

The seventh section is therapeutic outcomes and follow-up. Symptom changes and patient feedback during treatment and after completion of the treatment course should be recorded, emphasizing staged progression and continuity.

The eighth section is additional notes. This section may be used to explain Zhuang medicine-specific concepts, therapeutic thinking, or cultural background information, thereby reducing cross-cultural misunderstanding.



Through this structural framework, case record information can be presented hierarchically, enabling overseas readers unfamiliar with Zhuang medicine to gain a relatively complete understanding of the diagnostic and therapeutic process.

## **6. Terminological translation norms for overseas clinical case records of HUANGs' school of acupuncture and moxibustion of Zhuang medicine in Guangxi**

### **6.1. Principles and expression of disease name translation**

Disease names in Zhuang medicine are among the most culturally distinctive terminological categories in Zhuang medicine case records. Their naming conventions are often derived from long-term clinical experience, pointing not only to symptom manifestations but also to specific understandings of etiology and pathogenesis. In overseas case records, both literal translation and complete replacement with modern medical disease names may result in information distortion. Therefore, translation of disease name terminology should adhere to the principle of “Zhuang medicine disease names as the core, with functional explanatory support.” In translation, Zhuang medicine disease names should preferably be retained, using transliteration, phonetic rendering, or brief explanatory annotations describing main symptom characteristics. When relatively stable correspondences with modern medical diseases can be established, modern disease names may be added as references, provided that hierarchical distinctions are not blurred. They should not be treated as the sole or dominant expression. This approach helps clearly distinguish the functional roles of “Zhuang medicine disease names” and “modern medical disease names” within their respective knowledge systems, preventing Zhuang medicine terminology from being reduced to folk nomenclature or misconstrued as a direct substitute for modern medical diagnoses.

### **6.2. Standardized translation of acupuncture point and therapeutic technique terminology**

Acupuncture points and therapeutic techniques are the most frequently occurring and technically specialized terminological categories in HUANGs' Zhuang medicine acupuncture and moxibustion case records, and constitute the core embodiment of its technical characteristics. Improper handling of such terminology in overseas translation may easily lead to oversimplification or misinterpretation due to insufficient background knowledge. For acupuncture point terminology, the principle of “name retention with functional explanation as supplement” should be followed. For points unique to Zhuang medicine acupuncture and moxibustion or those not fully corresponding to traditional Chinese medicine acupoint systems, modern acupuncture or anatomical terms should not be imposed. Instead, original names should be retained, accompanied by brief explanations of approximate location or clinical function upon first occurrence. This approach maintains the technical independence of Zhuang medicine acupuncture and moxibustion while facilitating basic understanding among non-specialist readers. As Zhuang medicine is a distinct ethnic medical system, certain Zhuang medicine-specific acupoints lack international coding; therefore, international coding for these unique points should be developed to promote global dissemination of Zhuang medicine. Regarding therapeutic technique terminology—such as needling manipulation, tonification-sedation principles, and Zhuang medicine-specific operational methods—the focus of translation lies not in formal equivalence but in functional expression. Descriptive translation should be employed to highlight the role and operational characteristics of each technique within treatment.

### **6.3. Standardized expression of therapeutic outcome and follow-up terminology**

Therapeutic outcome descriptions are the most direct reflections of treatment results in case records, yet they

are also the most experience-based expressions. Common terms such as “significant improvement”, “symptoms basically resolved”, or “sleep returned to normal” have clear referential meanings in local contexts but may be perceived as lacking objectivity in overseas translation. To address this issue, translation of outcome terminology should adhere to the principle of “preserving original meaning while strengthening process-oriented expression.” On the one hand, original efficacy descriptions should not be arbitrarily replaced, ensuring faithful representation of patient subjective experiences and clinical observations. On the other hand, supplementation with time points or specific manifestations can enhance the interpretability of therapeutic changes. Follow-up terminology requires particular standardization, as overseas patient case records often document long-term follow-up, which not only demonstrates the durability of therapeutic effects but also strengthens academic credibility. Translation should ensure consistency in follow-up expressions, highlighting stability of outcomes, recurrence status, and overall patient condition changes, thereby providing clear textual foundations for database organization and outcome research.

## 7. Conclusion

Taking overseas case records from HUANGs’ Zhuang medicine acupuncture and moxibustion as its object, this study analyzes their structural composition, writing characteristics, and cultural contexts based on authentic clinical texts, and identifies potential misunderstandings and normative deficiencies arising in cross-cultural translation. Through systematic analysis, this paper proposes a normative framework for case record translation from both structural and terminological perspectives, balancing preservation of Zhuang medicine medical connotations with cross-cultural comprehension needs, and offering feasible approaches for standardized organization of such records.

The study argues that rational structural translation enhances textual hierarchy and readability, while terminological translation norms are key to safeguarding academic validity and medical subjectivity of Zhuang medicine case records. By clarifying functional attributes and hierarchical expression of different terminologies, it is possible to preserve Zhuang medicine characteristics while lowering cross-cultural comprehension barriers and avoiding simplistic assimilation or conceptual misinterpretation. Applying these norms to case record database construction can improve structural consistency and terminological uniformity of data, laying a foundation for systematic organization and further research on Zhuang medicine acupuncture and moxibustion clinical experience.

The proposed norms remain exploratory in nature, and their scope of applicability and operational details require further validation and refinement through larger-scale case practice. Future research may expand sample sizes, incorporate multilingual translation cases and information technologies, and continuously optimize operability and stability of the norms.

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# Deep Learning-Based Image Reconstruction in Electromagnetic Tomography: Recent Progress and Perspectives

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**Abstract:** Electromagnetic Tomography (EMT) is a non-destructive imaging modality that reconstructs internal conductivity or permittivity distributions by solving an ill-posed inverse problem. Traditional reconstruction methods, such as Linear Back Projection (LBP) and Conjugate Gradient (CG), often suffer from low accuracy, strong artifacts, and poor edge preservation due to ill-conditioned sensitivity matrices and noise amplification. In recent years, deep learning has provided new solutions for EMT image reconstruction through its strong nonlinear fitting ability and multi-scale feature extraction capability. With the development of encoder-decoder structures, skip-connection strategies, and attention mechanisms, a series of neural-enhanced EMT reconstruction models have emerged, effectively improving artifact suppression, multi-target discrimination, and real-time performance. Among them, U-Net-based frameworks and attention-augmented variants, such as CBAM-U-Net, demonstrate significant advantages in boundary restoration, feature refinement, and noise robustness. This review summarizes the major research progress of deep learning in EMT image reconstruction, outlines the evolution from hybrid shallow models to specialized deep architectures, and discusses future directions for multimodal fusion and advanced neural frameworks.

**Keywords:** Deep learning; Image processing; Electromagnetic Tomography (EMT)

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## 1. Introduction

Electromagnetic Tomography (EMT) is a non-destructive imaging technique based on electromagnetic induction principles, enabling contactless characterization of material properties<sup>[1]</sup>. Its advantages include non-invasiveness, safety, and real-time imaging capability. EMT processes detection signals through excitation, sensing, data transmission, and tomographic reconstruction, where the reconstructed field distributions quantitatively reflect internal electromagnetic parameters. Traditional reconstruction algorithms—including LBP, Tikhonov regularization, Landweber iteration, and Conjugate Gradient—face inherent limitations<sup>[2]</sup>. Ill-conditioned

sensitivity matrices cause noise amplification, while iterative methods incur heavy computational cost and spatial ambiguity in multi-object scenarios. For example, LBP reconstructions exhibit severe boundary localization errors, and CG approaches often require hundreds of iterations to converge. These limitations motivate the incorporation of data-driven priors and nonlinear mapping techniques <sup>[3]</sup>.

Deep learning offers strong nonlinear approximation capabilities and can obtain sufficient prior information through large-scale sample training <sup>[4]</sup>. By learning mappings between low-quality inputs (e.g., LBP/CG results) and high-fidelity ground truth images, neural networks bypass explicit inversion and automatically suppress artifacts. Encoder–decoder architectures with skip connections enable fusion of shallow edges and deep semantic features. When enhanced with attention mechanisms such as CBAM, networks achieve adaptive feature refinement and improved multi-target discrimination <sup>[5]</sup>.

The purpose of this review is to provide a systematic summary of current deep learning–based EMT reconstruction methods, clarify their development trajectory, and highlight their advantages and limitations from both theoretical and practical perspectives. By reorganizing representative progress and identifying key methodological trends, this review aims to offer a coherent reference for researchers entering the field and to support future work toward more robust and generalizable EMT imaging frameworks.

## 2. Definition of EMT image reconstruction

In EMT, reconstruction aims to map measured boundary voltages to internal conductivity or permittivity distributions <sup>[6]</sup>. According to the principle of electromagnetic induction, the EMT system satisfies the Maxwell differential equation

$$\begin{aligned}\nabla \times \vec{H} &= \vec{J} + \frac{\partial \vec{D}}{\partial t} \\ \nabla \times \vec{E} &= -\frac{\partial \vec{B}}{\partial t} \\ \nabla \cdot \vec{B} &= 0 \\ \nabla \cdot \vec{D} &= \rho\end{aligned}\tag{1}$$

The EMT object field is considered a “stable field”, which satisfies the condition:

$$\varepsilon\omega \ll \sigma$$

And the measured medium is linear and isotropic

$$\vec{D} = \varepsilon \vec{E}, \quad \vec{B} = \mu \vec{H}, \quad \vec{J} = \sigma \vec{E}\tag{2}$$

Where  $\varepsilon$  is relative dielectric constant,  $\mu$  is relative magnetic permeability and  $\sigma$  is conductivity. The vector magnetic potential  $\vec{A}$  is introduced to satisfy

$$\vec{B} = \nabla \times \vec{A}\tag{3}$$

Assuming the magnetic permeability is constant, the object field equation of EMT is



$$\nabla^2 A = j\omega\mu(x, y)\sigma(x, y)\vec{A} \quad (4)$$

Simplify the equation (4) to

$$\vec{A} = \frac{\nabla(\mu(x, y)^{-1}\nabla\vec{A})}{j\omega\sigma(x, y)} \quad (5)$$

According to the principle of electromagnetic induction, the output voltage  $U$  of each detection coil can be expressed as:

$$U = -\frac{d\varphi}{dt} = -n\frac{d(\vec{B}S)}{dt} = -n\frac{d(\vec{A}l)}{dt} = -nj\omega l(\vec{A}_1 - \vec{A}_2) \quad (6)$$

Deep learning reframes reconstruction as an image-to-image transformation problem <sup>[7]</sup>. Low-quality EMT images serve as physical priors, and neural networks perform refinement by extracting multi-scale features, enhancing edges, suppressing noise, and restoring structural details. Thus, deep learning provides a robust alternative definition of EMT reconstruction: physics-guided, data-driven posterior enhancement.

### 3. Recent research progress

Research on deep learning-based electromagnetic tomography (EMT) image reconstruction has progressed through several evolutionary stages, moving from early hybrid shallow models to specialized deep neural architectures tailored for complex inverse problems. In the early development of learning-assisted EMT methods, researchers attempted to incorporate radial basis function (RBF) neural networks, wavelet-enhanced estimators, and hybrid statistical learning models to compensate for the limitations of traditional algorithms <sup>[8]</sup>. These approaches demonstrated that introducing data-driven components could effectively improve the stability of conductivity estimation and alleviate the severe artifacts produced by classical iterative solvers. Although the capacity of these shallow models was limited, they laid an important foundation by illustrating that neural representations could embed structural priors absent from purely physics-based solvers.

The emergence of deep learning around 2018–2019 marked a significant shift in EMT research. Deep architectures such as stacked sparse autoencoders (SSAE), fully connected (FC) networks, and multi-scale convolutional sparse coding frameworks began to demonstrate superior reconstruction accuracy compared to classical methods <sup>[9]</sup>. These models were no longer restricted to simple post-processing; instead, they learned end-to-end mappings from coarse physical reconstructions—typically derived from LBP or CG—to ground-truth conductivity distributions <sup>[10]</sup>. As a result, they could recover high-frequency structural details and achieve millimeter-level resolution across a broad range of material configurations. Importantly, this stage confirmed that deep networks possess sufficient generalization capability to handle diverse physical fields, dynamic flow conditions, and imperfect measurement environments.

As research continued, the focus gradually shifted from adopting general neural architectures to designing EMT-specific deep models <sup>[11]</sup>. U-Net became one of the most influential structures due to its encoder-decoder symmetry and skip connections, which effectively combine shallow boundary information with deep semantic

representations<sup>[12]</sup>. This enabled more accurate edge localization and clearer structural depiction than both classical algorithms and earlier learning models. However, the unmodified U-Net still propagated redundant features through its skip pathways, resulting in blurred edges and reduced discrimination in multi-target scenarios. To overcome these limitations, attention mechanisms were introduced, with the Convolutional Block Attention Module (CBAM) emerging as an effective enhancement<sup>[13]</sup>. By integrating channel and spatial attention, CBAM-U-Net adaptively focuses on conductivity-sensitive regions and suppresses irrelevant background features, producing cleaner boundaries, stronger robustness to noise, and improved performance in complex multiphase and multi-object environments<sup>[14]</sup>. This attention-driven refinement has allowed EMT reconstruction networks to align more closely with the inherent physical characteristics of electromagnetic induction, thereby marking an important milestone toward high-fidelity, high-speed, and physics-aware deep reconstruction frameworks<sup>[15]</sup>.

## 4. Conclusion

Deep learning has reshaped EMT image reconstruction by providing data-driven solutions to ill-posed inverse problems. Through nonlinear feature learning, multi-scale fusion, and attention-based refinement, neural-enhanced approaches significantly improve artifact suppression, edge restoration, and multi-target discrimination compared with classical EMT algorithms. U-Net-based models and CBAM-enhanced variants represent important advances, offering high-fidelity imaging with real-time inference capability.

Future research should explore multimodal integration, real-world dataset expansion, and the adoption of advanced architectures such as Transformers and generative adversarial networks. These developments are expected to further improve robustness, generalization, and interpretability in EMT applications.

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# Research on the Application of Rapid Food Detection Technology in Cross-border Food Supervision

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**Abstract:** Food quality and safety are related to public health and life safety, and are the core issues of food supervision work. With the rapid development of the cross-border food industry, the complexity of the food supply chain has continuously increased. Traditional laboratory detection methods are difficult to meet the needs of real-time and rapid supervision due to limitations such as long time consumption and cumbersome processes. With its characteristics of speed, convenience, and efficiency, rapid food detection technology plays an increasingly important role in cross-border food supervision and has become a key technical support for ensuring food safety. Based on this, this paper focuses on introducing the application practice of rapid food detection technology in cross-border food supervision, and analyzes its application paths in cross-border food supervision from four aspects: raising attention, optimizing application processes, strengthening team building, and improving the institutional system, aiming to provide reference for the application of rapid food detection technology in cross-border food safety supervision.

**Keywords:** Food; Rapid detection technology; Cross-border; Food supervision

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## 1. Application status of rapid food detection technology in the food supervision industry

### 1.1. Application characteristics of rapid food detection technology

Rapid food detection technology shows significant speed advantages in practical applications, capable of completing the analysis and judgment of harmful substances or key indicators in food samples in a short time <sup>[1]</sup>. Traditional laboratory detection usually takes hours or even days for sample pretreatment, instrumental analysis, and result confirmation, while rapid detection technology compresses the entire detection cycle to a few minutes to tens of minutes through integrated reagents, portable equipment, and real-time reading systems.

The operation process of this technology is highly convenient. Most rapid detection methods are designed as modular processes, which can be independently completed on-site by front-line supervisors without complex professional training. For example, immunochromatographic test strips, color card kits, and handheld spectrometers all support simple steps of “sampling — adding reagents — observing results”, and some equipment is also equipped with intelligent terminal connection functions to realize automatic data collection and transmission <sup>[2]</sup>.

Economically, the cost of rapid food detection technology is significantly lower than that of traditional physical and chemical analysis methods <sup>[3]</sup>. This is mainly reflected in low equipment investment, controllable consumable prices, and low labor demand. The purchase cost of conventional high-performance liquid chromatography or mass spectrometry instruments is high, maintenance is complex, and professional and technical personnel are required to be on duty for a long time. In contrast, the portable devices relied on by rapid detection have a low unit price, strong reusability, and supporting reagents are mostly supplied in mass production, further reducing the cost of a single detection.

These characteristics together form the practical foundation of rapid food detection technology in cross-border supervision scenarios. The improvement of detection speed responds to the strict requirements of international trade for timeliness, the simplicity of operation ensures the implementability of the technology in various environments, and the low-cost structure provides economic feasibility for continuous and regular monitoring. The combination of the three makes rapid detection not only an effective tool for risk preliminary screening but also creates conditions for establishing a dynamic response mechanism, promoting the development of cross-border food safety governance towards efficiency, precision, and sustainability <sup>[4]</sup>.

## **1.2. Application scenarios of rapid food detection technology**

In the source control stage, rapid detection technology is widely used in initial links such as agricultural product planting, livestock and poultry breeding, and aquatic product fishing. On-site screening of pesticide residues, veterinary drug residues, heavy metal pollution, and prohibited additives that may exist in soil, water sources, feed, and animals and plants through portable detection equipment can effectively identify potential risk factors <sup>[5]</sup>. In export-oriented agricultural production bases, rapid detection methods have realized the whole-process data tracking from the field to before export declaration, improving the authenticity and traceability of source data.

After entering the production and processing link, rapid food detection technology is mainly used for raw material acceptance, processing process control, and finished product factory inspection. In cross-border food production enterprises, raw materials come from different countries or regions with complex components and inconsistent standards. Rapid detection methods can complete the screening of microbial pollution, toxin content, allergenic substances, and illegal additives in a short time to ensure that products meet the quality and safety regulations of the importing country. At the same time, some automated rapid detection systems have been integrated into production lines to realize online dynamic monitoring, further improving the precision and coverage of supervision <sup>[6]</sup>.

In the circulation and sales stage, rapid food detection technology has become an important tool to cope with the complexity of cross-border logistics and market diversity. Since cross-border food usually undergoes long-distance transportation, multi-node warehousing, and cross-border distribution, it is vulnerable to temperature fluctuations, packaging damage, and cross-contamination. Therefore, rapid detection methods are widely used in



port inspection, bonded warehouse sampling inspection, and retail terminal supervision. With the help of mobile rapid detection vehicles and handheld Raman spectrometers, customs supervision departments can complete the preliminary determination of adulterated components, genetically modified components, or excessive preservatives in imported food within a few minutes, greatly shortening the customs clearance time. The rapid response capability at this stage not only enhances consumer confidence but also improves the risk prevention and control level of the entire cross-border food supply chain.

### **1.3. Common rapid food detection technologies**

Molecular biology rapid detection methods occupy an important position in rapid food detection, and are widely used in cross-border food supervision due to their advantages of high sensitivity, strong specificity, and short cycle <sup>[7]</sup>. Among them, polymerase chain reaction (PCR) technology is the core means, which realizes the accurate identification of pathogens by amplifying specific DNA fragments of target microorganisms. Quantitative real-time PCR further improves the visualization and quantitative capabilities of detection, and can complete the detection of common foodborne pathogens such as *Salmonella*, *Listeria monocytogenes*, and *Escherichia coli* O157:H7 within a few hours, which is suitable for on-site screening of imported meat products, dairy products, and aquatic products. Combined with specific primer and probe design, this technology can effectively distinguish live bacteria from dead bacteria, reduce false positive results, and improve the scientificity of regulatory decisions.

Loop-mediated isothermal amplification (LAMP) technology, as an emerging molecular detection method, achieves efficient amplification without complex temperature cycling equipment, making it particularly suitable for on-site rapid detection at ports <sup>[8]</sup>. The reaction process is carried out at a constant temperature, usually 60–65 °C, for 30–60 minutes to complete the detection. Combined with visually observable color changes or turbidity to judge results, it significantly reduces the dependence on professional instruments. LAMP has been successfully applied to the simultaneous screening of pesticide residue-associated microbial contamination in cross-border fruits and vegetables, as well as the rapid identification of *Vibrio parahaemolyticus* in frozen seafood, with good on-site applicability.

Gene chip technology realizes the simultaneous detection of multiple pathogens through high-throughput parallel analysis of multiple target gene sequences. When facing a type of imported food with complex sources and diverse batches, this technology can screen dozens of potential pathogenic microorganisms at one time, improving the coverage and efficiency of supervision. Although the current equipment cost is relatively high, with the development of microfluidic and integrated platforms, portable gene chip detection systems have gradually entered the practical stage, providing stronger technical support for border inspection institutions <sup>[9]</sup>.

## **2. Application strategies of rapid food detection technology in cross-border food supervision**

### **2.1. Attach importance to food supervision and increase support for rapid food detection technology**

Relevant national departments should formulate and issue special policy documents for rapid food detection technology, establish the legality and authority of rapid detection technology from the top-level design, and clarify its legal status and technical standards in the import and export inspection and quarantine process. By incorporating rapid detection technology into the formal supervision process and endowing it with the same effectiveness as traditional laboratory detection or the legal function as a pre-screening tool, the law enforcement

basis and technical credibility are enhanced. Policy guidance should also reflect the incentive orientation for technological innovation and industrial development, encouraging scientific research institutions, universities, and enterprises to jointly carry out key technological research, and promoting breakthroughs in key areas such as new sensing materials, portable instrumentation, and intelligent data analysis systems<sup>[10]</sup>.

Financial investment is an important guarantee for technological implementation. The government needs to set up special funds to support the construction of rapid detection capabilities at border ports, bonded areas, and key import distribution centers. Funds can be used to purchase advanced rapid detection equipment with high sensitivity and multi-item joint inspection, update old facilities, and modernize detection capabilities<sup>[11]</sup>. Support the construction of regional rapid detection centers to form a technical network covering major import and export channels. Introduce a performance evaluation mechanism in the process of fund use to ensure that funds are used for specific purposes and improve the efficiency of fund use. Give preferential support to grass-roots supervision units in equipping basic rapid detection equipment to narrow the gap in supervision capabilities between regions. Through continuous capital injection and technological iteration, the rapid detection system can always maintain the ability to respond to emerging pollutants, illegal additives, and unknown risk factors, and effectively build a cross-border food safety defense line.

## **2.2. Optimize rapid detection processes and improve the application efficiency of cross-border rapid food detection**

First, establishing an efficient and scientific rapid detection process helps shorten the detection cycle, improve customs clearance efficiency, and ensure the safety of imported food<sup>[12]</sup>. Based on the current characteristics and risk distribution of cross-border food circulation, relevant government supervision departments should organize professional and technical forces to formulate unified and operable rapid detection operation guidelines, clarifying the technical parameters and implementation specifications of each step. Through the issuance and promotion of standardized documents, break the result deviations caused by operational differences between regions and departments, and realize homogeneous and same-standard detection work at ports, logistics hubs, and border checkpoints, enhancing the mutual recognition and authority of detection data.

In the actual supervision process, avoid relying solely on a single detection method, and take rapid detection as one of the core tools to organically combine with other inspection modes. Conventional laboratory inspection has high accuracy and is suitable for confirmatory analysis; sampling inspection can reflect the quality status of the entire batch; while rapid detection highlights the advantages of “speed” and “convenience”, and is suitable for large-scale screening in the early stage of entry. Reasonably embed the three into the supervision chain to form a progressive inspection mechanism of “preliminary screening — classification — precise inspection”, which can not only improve the discovery probability of problematic food but also reduce the resource pressure caused by comprehensive inspection and submission. For example, during the customs clearance of imported fresh products, priority is given to on-site pesticide and veterinary drug residue detection using immunochromatographic test strips or portable Raman spectrometers, and suspected positive samples are transferred to laboratories for quantitative verification, so as to achieve precise risk interception<sup>[13]</sup>.

Build a cross-border rapid food detection data sharing platform to realize real-time upload, automatic comparison, and early warning push of detection results, helping supervision departments dynamically grasp the food safety situation. Cooperate with electronic labels, blockchain traceability, and other technologies to ensure that the identity of detection objects is traceable, the process is monitorable, and the results are reviewable. At the

same time, promote the intelligent upgrading of detection equipment, develop multi-functional integrated portable devices, reduce the dependence on operators' experience, and further improve the stability and response speed of on-site detection. The continuous improvement of the process also needs to be regularly evaluated based on actual operation feedback, identify bottleneck links, and implement dynamic adjustments, ensuring that the rapid detection system always adapts to the development rhythm of cross-border trade and the changing trends of new security threats.

### **2.3. Strengthen the rapid detection team and cultivate high-quality cross-border rapid food detection talents**

Strengthening the construction of the cross-border rapid food detection team is crucial to building a scientific and systematic talent training mechanism. Institutions of higher learning, vocational training institutions, and supervision departments can cooperate to offer professional courses targeting rapid food detection technology, strengthen the teaching of microbial detection, chemical residue analysis, molecular biology technology, and other contents, ensuring that talents have a solid professional foundation<sup>[14]</sup>.

Establishing a scientific and reasonable assessment mechanism is important for maintaining team vitality. Set unified assessment standards to comprehensively evaluate rapid detection personnel from multiple dimensions, such as theoretical knowledge, practical operation, emergency response, and professional ethics. The assessment cycle is set to once every six months or a year, organized by an independent third-party institution or a higher-level supervision department to ensure an objective and fair evaluation process. The assessment results serve as an important basis for post appointment, professional title promotion, and salary adjustment, realizing the matching of ability and treatment. Commend and reward those with excellent results to stimulate their work enthusiasm; arrange supplementary training and re-examination for those who fail to meet the standards, and transfer them from key positions if necessary, forming a management mechanism of "able to be promoted and demoted." Through continuous talent training and strict ability evaluation, build a professional, standardized, and international cross-border rapid food detection technical team, providing solid human support for building a national food safety defense line.

### **2.4. Improve rapid detection systems and strengthen the supervision of rapid food detection technology**

Establishing a scientific and perfect technical standard system for rapid food detection is the basic guarantee for the effectiveness of cross-border food supervision. Led by relevant supervision departments, joint scientific research institutions, detection units, and technical experts to formulate unified rapid detection technical specifications, covering detection equipment performance indicators, reagent use conditions, operation process steps, and result interpretation basis. For different types of food pollutants, such as pesticide residues, heavy metals, pathogenic microorganisms, and illegal additives, set corresponding detection limits and judgment thresholds to ensure the comparability and consistency of various rapid detection methods in practical applications<sup>[15]</sup>.

Cross-border food supervision involves the connection of regulations and detection systems of multiple countries, requiring the promotion of coordination and mutual recognition of international rapid detection standards. Actively participate in relevant activities of international standardization organizations, learn from advanced experiences from the European Union, the United States, Japan, and other regions, and revise and improve local standards in combination with China's actual needs. Encourage domestic rapid detection technology

R&D units to participate in international proficiency testing projects to improve the credibility of detection results. Establish standardized rapid detection laboratories at border ports, equip certified instruments and consumables, strictly implement standard operating procedures, and ensure the transparency, traceability, and reviewability of the detection process of cross-border food at the entry link. Support the construction of an information management system to realize real-time upload, automatic analysis, and abnormal early warning of detection data, improving the speed and accuracy of regulatory decisions.

### 3. Conclusion

In summary, rapid food detection technology plays an irreplaceable role in cross-border food supervision, providing strong support for the rapid screening of problematic food and the timely prevention of food safety risks. With the continuous progress and improvement of such technologies, their application in cross-border food supervision will become more extensive and in-depth. In the future, all parties need to work together to further consolidate the food safety risk prevention and control system by optimizing personnel training, improving infrastructure, and enhancing the quality of rapid food detection products, building a solid food safety barrier, and providing support for ensuring food safety.

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# The Influence of Nonlinear Damping on the Transport Properties of Brownian Particles

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**Abstract:** This paper studies the directed transport of Brownian particles in a flashing ratchet under a nonlinear damping environment. The research shows that the nonlinear relationship between the damping term and velocity can transform the system from a passive energy dissipation mode to a nonequilibrium process of actively acquiring energy from the environment. This study not only reveals the complex interaction mechanism between nonlinear damping and system energy dissipation but also breaks the limitations of linear theory in describing nonequilibrium energy conversion. It provides a new theoretical perspective for in-depth understanding of the dynamic behavior of micro-nonequilibrium systems, and has important theoretical significance and application value.

**Keywords:** Nonlinear damping; Brownian particles; Flashing ratchet; Directed transport

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## 1. Introduction

Biomolecular motors (such as ATP synthase and myosin) serve as core “machines” for energy conversion in living systems, capable of converting chemical energy into mechanical energy at the nanoscale with nearly 100% efficiency<sup>[1–3]</sup>. For example, ATP synthase on the inner mitochondrial membrane, as a sophisticated rotary molecular motor, can use the proton transmembrane gradient to drive the rotation of its “rotor” component, thereby efficiently catalyzing the synthesis of ATP, which is the core mechanism of biological energy conversion<sup>[4–6]</sup>. To understand the microdynamics and energy conversion of biomolecular motors in organisms from a physical perspective, models such as the “Brownian ratchet” have been proposed based on Brownian particle theory<sup>[7]</sup>. Brownian particles refer to microscopic particles suspended in a fluid medium that undergo irregular motion due to random collisions with surrounding molecules, acting as a bridge connecting the microscopic world and macroscopically observable phenomena<sup>[8–9]</sup>. In fact, the working environment of Brownian particles is usually a medium with viscosity much greater than inertia, such as liquids or gases<sup>[10]</sup>. Due to the irregular thermal motion of molecules in the environment, particles are continuously subjected to random forces, resulting in random and

uncertain motion. Linear damping, as a classic ideal model describing energy dissipation in such systems, has a damping force proportional to the first power of the motion velocity, with the mathematical expression  $F = -\gamma_0 v$  (where  $\gamma_0$  is the damping coefficient and  $v$  is the instantaneous velocity of the object). As a universal model for passive energy dissipation, this model can be used to describe the conversion and dissipation of system mechanical energy into thermal energy or other forms of energy <sup>[11–12]</sup>.

However, the classic linear damping model has limitations in describing the complex motion of real molecular motors. In this regard, this paper introduces a new form of damping—Rayleigh-Helmholtz damping (referred to as RH damping) to overcome the shortcomings of linear damping, thereby generating richer dynamic behaviors <sup>[13]</sup>. According to the fluctuation-dissipation theorem, the energy exchange between particles and the surrounding medium is usually determined by both damping forces and random forces <sup>[14]</sup>. In a linear damping environment, the system's energy is mainly passively dissipated through friction or viscous resistance from the external environment, leading to relatively low dissipation efficiency. The introduction of nonlinear damping can establish a dynamic balance between energy input and dissipation, preventing the system from becoming unstable due to over-driving, thereby maintaining stable operation of the system in a nonequilibrium environment <sup>[15]</sup>. For example, Klimontovich's nonlinear damping theory reveals that atoms in a laser cooling field convert external light energy into internal momentum through a nonlinear dissipation mechanism, realizing the transformation from passive to active energy absorption, and providing a key theoretical framework for energy conversion in active matter.

Therefore, this paper establishes a stochastic dynamic model of Brownian particles in a flashing ratchet and studies the influence of nonlinear damping on their directed transport. From the perspective of energy dissipation, this study reveals that nonlinear damping breaks detailed balance, drives the system away from equilibrium, and achieves directed flow, providing new ideas for understanding the directed transport of Brownian particles in nonequilibrium statistical physics.

## 2. Model

This paper mainly studies the transport properties of Brownian particles in a flashing ratchet under a nonlinear damping environment, and their dynamic behavior can be described by the following motion equation:

$$\dot{x} = v, \quad \dot{v} = -\gamma(v)v - \frac{\partial V(x)}{\partial x} Z(t) + \xi(t) \quad (1)$$

where  $x$  represents the position coordinate of the particle,  $v$  represents the velocity of the particle,  $\gamma(v)$  denotes the Rayleigh-Helmholtz damping function, whose expression is:

$$\gamma(v) = \gamma_0(v^2 - v_0^2) \quad (2)$$

Here,  $\gamma_0$  is the intensity parameter of the damping coefficient, and  $v_0$  is the characteristic velocity.

This paper considers Brownian particles moving in a flashing ratchet, so the specific form of  $V(x)$  is:

$$V(x) = \begin{cases} \frac{V_0}{\lambda} x, & (0 < x \leq \lambda), \\ \frac{V_0}{L - \lambda} [L - x], & (\lambda < x \leq L), \end{cases} \quad (3)$$

where  $V_0$  represents the barrier height,  $L$  is the spatial period of the flashing potential, and  $\lambda$  is the asymmetry coefficient.

The flashing switch  $Z(t)$  form of the potential field is  $Z(t) = \begin{cases} 1, n\tau < t \leq n\tau + \tau_{on} \\ 0, n\tau + \tau_{on} < t \leq (n+1)\tau \end{cases}$ , where  $\tau_{on}$  denotes the time the potential field remains “on”,  $\tau_{off}$  denotes the time the potential field is “off”, and its period is  $\tau = \tau_{on} + \tau_{off}$ , where  $n = 0, 1, 2, \dots$ .

In Equation (1),  $\xi(t)$  represents Gaussian white noise, which satisfies the following relations:  $\langle \xi(t) \rangle = 0$ ,  $\langle \xi(t)\xi(t') \rangle = 2D\delta(t-t')$ , where  $D = k_B T$  is the noise intensity,  $k_B$  is Boltzmann’s constant, and  $T$  is the external temperature.

This paper uses the second-order Runge-Kutta method to numerically calculate the average velocity of Brownian particles, whose specific form is as follows:

$$\langle \dot{x} \rangle = \lim_{t \rightarrow \infty} \frac{\langle x(t) - x(0) \rangle}{t} \quad (4)$$

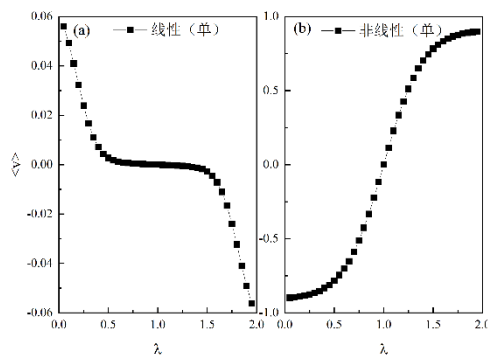
To obtain a stable ensemble average, this paper selects a time step  $h = 1 \times 10^{-3}$ , simulates  $1 \times 10^5$  trajectories, and each trajectory evolves for  $10^6$  steps. Other parameters:  $\gamma_0 = 3.0, v_0 = 1.0, V_0 = 1.0, D = 0.1, L = 2.0, \tau_{on} = \tau_{off} = 2.0$ .

### 3. Results and discussion

This paper discusses the dependence of the transport properties of Brownian particles on the asymmetry coefficient  $\lambda$ . The results show that in a linear damping environment, the average velocity  $\langle v \rangle$  of Brownian particles changes non-monotonically with the asymmetry coefficient. It is not difficult to see from Equation (3) that the potential field is symmetrically distributed when  $\lambda = 1.0$ , and particles cannot form an obvious directed flow at this time. However, when  $\lambda \neq 1.0$ , the potential field has obvious asymmetry, and the system can generate a net directed flow under time-periodic regulation. Specifically, when the potential field is in the “on” state (potential field is “activated”), Brownian particles are confined in potential wells because the external environment cannot provide sufficient energy to cross the potential barrier, making it difficult to form directed motion. After a period of time, when the potential field switches to the “off” state (potential field is “deactivated”), thermal noise drives Brownian particles to move freely, resulting in their uniform distribution in space. When the potential field is “turned on” again, due to the spatial asymmetry of the potential field, the probability of particles “sliding” into the potential wells from both sides of the barrier top is different, thereby generating a “net” directed flow. In other words, when  $\lambda < 1.0$ , the spatial size of the left side of the barrier is significantly smaller than that of the right side, so the probability of Brownian particles sliding from the barrier top to the left side of the potential well is lower than that to the right side. Conversely, when  $\lambda > 1.0$ , the spatial size of the left side of the barrier is larger, so particles will generate a negative directed flow. Its essence is the combined effect of the spatiotemporal symmetry breaking of the potential field and thermal noise, which breaks the detailed balance and time-reversal symmetry of the system, thereby inducing a “net” directed flow of Brownian particles.

However, in the RH damping environment, Brownian particles exhibit different transport behaviors (as shown in **Figure 1(b)**). This is due to the nonlinear relationship between the RH damping term and the particle velocity—even when Brownian particles are not driven by external energy sources, RH damping can continuously provide energy for the particles. More importantly, when  $\lambda \neq 1.0$ , even though the flashing ratchet periodically

resets the spatial distribution of Brownian particles, RH damping can inject sufficient energy into the particles to cross the potential barrier. For example, when  $\lambda > 1.0$ , the average velocity of Brownian particles in the linear damping environment is negative, while Brownian particles in the nonlinear damping environment can obtain sufficient energy to cross the potential barrier, showing positive transport characteristics (average velocity greater than zero). This further confirms that RH damping can provide sufficient energy for particles to cross the potential barrier, thereby realizing directed transport.



**Figure 1.** Curves of the average velocity  $\langle v \rangle$  of Brownian particles varying with the asymmetry coefficient  $\lambda$

#### 4. Conclusions and prospects

By establishing a stochastic dynamic model, this paper systematically studies the transport behavior of Brownian particles in a flashing ratchet and explains the mechanism of RH damping on the directed transport of Brownian particles. Its physical essence lies in the fact that RH damping breaks the spatiotemporal reversal symmetry and detailed balance conditions of the flashing ratchet, thereby inducing particles to form a directed flow. From the perspective of energy dissipation, this study shows that nonlinear dissipation, as an externally tunable parameter, can effectively control the intensity and direction of the directed flow. This theory provides a new perspective for understanding the energy conversion of biomolecular motors in organisms and developing the dissipation-fluctuation coordination theory in nonequilibrium statistical physics. On the one hand, this study reveals how molecular motors realize directed motion using chemical energy (such as ATP hydrolysis) in a nonequilibrium state, a process that is essentially “controlled” nonlinear dissipation. On the other hand, this model can describe the adaptive behavior of molecular motors in complex cellular environments (such as viscous media, periodic potential fields, and non-conservative force fields), explaining the mechanism of maintaining directed motion and efficient energy conversion under external disturbances. This research not only deepens people’s understanding of the energy conversion mechanism in living systems but also provides an important theoretical basis for the design optimization of artificial molecular motors and biophysical regulation strategies based on nonequilibrium thermodynamics. In addition, the important bridge established by the nonlinear damping model between stochastic dynamics and active matter motion broadens the application scope of fluctuation theorems in nonequilibrium systems and provides a theoretical basis for describing the entropy production dynamics and response characteristics of different nonequilibrium systems. In the future, research in this direction will play a key role in connecting basic theories with interdisciplinary fields such as life sciences and materials, further deepening people’s understanding of random fluctuations and complex system dynamics.

## Disclosure statement

The authors declare no conflict of interest.

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# The Essence and Significance of Work Based on Socialist Core Values

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**Abstract:** Since the 18th National Congress of the Communist Party of China, the President of the CPC has put forward a series of new ideas, viewpoints, and judgments around cultivating and practicing socialist core values, forming important theoretical achievements on this topic. The Report to the 19th National Congress further pointed out: “We will advocate prosperity, democracy, civilization, and harmony; advocate freedom, equality, justice, and the rule of law; advocate patriotism, dedication, integrity, and friendliness; and actively cultivate and practice core socialist values.” This is a summary and refinement of the experience in building socialist core values since the 18th National Congress. Implementing the President of the CPC’s important expositions on cultivating and practicing socialist core values is of great and far-reaching significance for advancing the great cause of socialism with Chinese characteristics.

**Keywords:** Socialist core values; Cultivation and practice; Essence and significance of work

**Online publication:** January 30, 2026

## 1. Introduction

In the system of socialist core values, “prosperity, democracy, civilization, and harmony” are the value goals at the national level, “freedom, equality, justice, and the rule of law” are the value orientations at the social level, and “patriotism, dedication, integrity, and friendliness” are the value criteria at the civic level. At the individual level, one’s value orientation should be measured by “patriotism and friendliness.” As the core content of the construction of socialist culture with Chinese characteristics, integrating socialist core values into people’s daily work enables people to better understand and grasp the essence and significance of work, fully recognize their social responsibilities and historical missions, consciously establish correct outlooks on life and values, thereby improving work quality and efficiency<sup>[1]</sup>.

## **2. Fully grasp the important significance of cultivating and practicing socialist core values**

In his speech at the National Conference on Propaganda and Ideological Work, the President of the CPC profoundly expounded the status and role of socialist core values in contemporary Chinese society. He pointed out: “Cultivating and practicing socialist core values is not only a key link in improving national quality and enhancing cultural confidence but also an inherent driving force for promoting the modernization of the national governance system and governance capacity. It is both the cornerstone of strengthening ideological and political work and the core content of building socialist spiritual civilization.” These remarks profoundly reveal the importance of cultivating and practicing socialist core values in the new era <sup>[2]</sup>.

Over time, people have become more aware that internalizing these values in the mind and externalizing them in action has become a major task related to the future development direction and national image building. By continuously promoting education on socialist core values, people can effectively guide the broad masses of people to form correct worldviews, outlooks on life, and values, thereby providing strong spiritual support and moral strength for China’s economic and social development.

Furthermore, cultivating and practicing socialist core values plays an irreplaceable role in realizing the Chinese Dream of national rejuvenation. It can not only unite the common will of the people of all ethnic groups but also stimulate tremendous social vitality and creativity, injecting a steady stream of positive energy into the cause of socialism with Chinese characteristics. At the same time, it is also an important guarantee for safeguarding national unity and promoting ethnic harmony, helping to build a harmonious and stable social environment and ensuring China’s long-term stable development <sup>[3]</sup>.

Therefore, people must fully recognize the profound significance of cultivating and practicing socialist core values, regard this work as a common responsibility of the whole society, carry out in-depth publicity and education activities, and make it a code of conduct consciously followed by every citizen. Only in this way can people continuously enhance the civilized quality of the whole nation, push the construction of socialist spiritual civilization to a new level, and provide a solid ideological guarantee and spiritual motivation for building a great modern socialist country in all respects and realizing the Chinese Dream <sup>[4]</sup>.

## **3. Cultivating and practicing socialist core values is an important guarantee for building a harmonious society**

Building a harmonious socialist society is not only a strategic choice of the country but also a historical responsibility that every Chinese should shoulder together. Since the proposal of creating a new situation in the cause of socialism with Chinese characteristics during the journey of building a moderately prosperous society in all respects, this major task has been put on the agenda. The vision of a harmonious society aims to build an ideal society where all people can give full play to their potential, find a social environment suitable for their own development, and achieve harmonious coexistence on this basis <sup>[5]</sup>. It means that all aspects of society—political, economic, social, cultural, etc.—can be properly coordinated and balanced, contradictions and conflicts among the people can be resolved in a timely and fair manner, and social fairness and justice can be effectively maintained and realized.

To build such a harmonious socialist society, people must adhere to the scientific outlook on development as the fundamental guide, which is not only a guiding ideology but also a practical guideline. The scientific outlook on development emphasizes putting people first, focusing on overall planning and coordination, emphasizing

sustainable development, and highlighting reform and innovation<sup>[6]</sup>. Guided by this, people can more scientifically handle various contradictions among the people, avoid the intensification of interest conflicts, and maintain social stability and harmony. At the same time, improving the socialist market economic system and expanding opening up can provide new momentum for economic growth, promote the effective allocation of domestic and foreign resources, and promote economic restructuring and upgrading.

In addition, building a country, government, and society under the rule of law is an important guarantee for realizing a harmonious society<sup>[7]</sup>. The rule of law is the basic way of governing the country. Only by combining governing the country according to the law, exercising administration according to the law, and building a society under the rule of law can a good social order be formed. Regulate people's behaviors through legal systems, ensure fairness and justice, and thus maintain the overall harmony of society.

To this end, people need the joint efforts of the whole society. Every citizen should actively participate in the construction of a harmonious society and contribute to building a harmonious society through voluntary services, community work, or every bit of behavior in daily life<sup>[8]</sup>. Only when everyone realizes their responsibilities and takes practical actions can people truly realize the beautiful vision of all people doing their best, getting their due, and living in harmony. Building a harmonious socialist society is a complex and arduous task, but as long as people persist unremittingly, dare to explore, and continuously promote the implementation of various policies and measures, people will surely gradually achieve the harmonious state that people pursue, laying a solid social foundation for realizing the Chinese Dream of national rejuvenation<sup>[9]</sup>.

#### **4. Cultivating and practicing socialist core values is an inevitable requirement for strengthening the construction of spiritual civilization**

The construction of spiritual civilization is an important part of the socialist modernization drive, a spiritual motivation for promoting the sustained and healthy development of the economy and society, and an important foundation for maintaining social harmony and stability. Vigorously cultivating and practicing socialist core values, and forming and promoting positive, healthy, and civilized ideas and moral customs in the whole society, play an important role in improving citizens' ideological and moral qualities and promoting economic and social development<sup>[10]</sup>. Only by integrating core values into the whole process of spiritual civilization construction and all aspects of people's daily life can people better serve the people, serve reform, development, and stability, and serve to consolidate the common ideological foundation for the unity and struggle of the whole Party and the people of all ethnic groups. Therefore, people must actively cultivate and practice socialist core values to provide spiritual motivation and intellectual support for the construction of material civilization<sup>[11]</sup>.

The construction of spiritual civilization is not only the core of the socialist modernization drive but also an important manifestation of a country's soft power. It is related to the improvement of people's ideological realm, moral cultivation, and cultural literacy, and plays an irreplaceable role in building a harmonious society and promoting the all-round progress of the economy and society. In this process, the cultivation and practice of socialist core values are particularly crucial. By widely disseminating and practicing these core values, people can create a positive, healthy, and upward spiritual atmosphere and moral customs in the whole society<sup>[12]</sup>.

Such an atmosphere and customs can not only help improve citizens' ideological and moral levels but also effectively stimulate the innovative vitality and development momentum of the whole society. They can guide people to establish correct worldviews, outlooks on life, and values. As an ancient saying goes: "When granaries

are full, people know etiquette; when food and clothing are sufficient, people know honor and disgrace.” The enrichment of material life has laid a solid foundation for the construction of spiritual civilization, and at the same time, the achievements of spiritual civilization construction have provided strong spiritual motivation and intellectual support for the sustained development of material civilization.

In short, the construction of spiritual civilization is an important part of the Party’s governance strategy and a powerful spiritual force for realizing the Chinese Dream of national rejuvenation. Let people work together with greater enthusiasm to engage in the construction of spiritual civilization, continuously push China’s spiritual civilization construction to a new level, and contribute wisdom and strength to building a great modern socialist country in all respects and realizing the Chinese Dream of national rejuvenation <sup>[13]</sup>!

#### **4.1. Cultivate socialist core values**

The Report to the 18th National Congress clearly proposed the socialist core values of “advocating prosperity, democracy, civilization, and harmony; advocating freedom, equality, justice, and the rule of law; advocating patriotism, dedication, integrity, and friendliness”, which is a concise summary and refinement of the socialist core value system. The national spirit with patriotism as the core and the spirit of the times with reform and innovation as the core are the essence of the socialist core value system and the internal driving force for its existence and development. Therefore, people must thoroughly study and implement the spirit of the 18th National Congress of the Communist Party of China, earnestly practice socialist core values, and provide strong spiritual motivation and intellectual support for building a prosperous, democratic, civilized, harmonious, and beautiful great modern socialist country.

Here are some superficial views on how to cultivate socialist core values: First, people must vigorously promote the national spirit. The Chinese nation has a 5,000-year history of civilization, with hard work, courage, love for peace, pursuit of justice, and excellent traditional culture, whose core is patriotism. People must take promoting the national spirit as an important content of cultivating socialist core values, educate and guide the broad masses of cadres and people to inherit and carry forward the fine traditions of the Chinese nation, consciously integrate personal pursuits into national development, and make unremitting efforts to realize the great rejuvenation of the Chinese nation <sup>[14]</sup>.

Second, people must vigorously strengthen the construction of citizens’ ideological and moral qualities. People must adhere to putting people first, be close to the masses, continuously improve working methods, and guide people to pursue noble moral sentiments and cultivate good social customs. People must deepen mass spiritual civilization creation activities, and extensively carry out activities to create civilized industries, civilized units, and civilized communities.

#### **4.2. Practice socialist core values**

As the value cornerstone of our country, socialist core values not only embody the traditional virtues and spirit of the times of the Chinese nation but also reflect the essential requirements pursued by the great cause of socialism. Rooted in a profound cultural soil, they absorb the wisdom and essence of 5,000 years of Chinese civilization, and at the same time keep pace with the times in the continuous development of the times, showing unique Chinese characteristics and national styles. In this context, people must actively advocate and practice these values and build a harmonious and progressive society under their guidance.

To achieve this goal, people need to carry out extensive education work across the whole society to



ensure that the cultivation of socialist core values becomes part of everyone's daily life. From kindergartens to universities, from families to communities, people must sow the seeds of these values and let them take root and germinate in every corner. At the same time, people must integrate them into all links of the national education system, making them deeply rooted in the hearts of the people through various forms of learning and practice activities.

In addition, the cultivation of socialist core values should not be limited to school classrooms but should extend to every corner of the whole society. In many fields, such as economic construction, political construction, cultural construction, and social construction, the requirements and orientations of these core values should be reflected. People should take the opportunity of various major commemorative days, traditional festivals, and cultural activity weeks to organize rich and colorful mass spiritual civilization activities, such as voluntary services, environmental protection, and civilized travel. These activities can effectively convey positive energy, enhance citizens' awareness, and promote social harmony <sup>[15]</sup>.

## 5. Conclusion

Socialist core values are our common belief and the ideological foundation for uniting the people. In future work, people must adhere to the guidance of President of the CPC Thought on Socialism with Chinese Characteristics for a New Era, fully implement the spirit of the 19th National Congress of the Communist Party of China, actively cultivate and practice socialist core values, guide social trends with socialist core values, enhance people's recognition and sense of belonging to socialist core values, and give full play to their positive role in building consensus and gathering strength. At the same time, people must take socialist core values as the guide, give full play to the publicity and guiding role of mainstream media, actively carry out various thematic practice activities, promote the harmonious and stable development of society, and provide spiritual motivation and intellectual support for realizing the great rejuvenation of the Chinese nation.

## Disclosure statement

The author declares no conflict of interest.

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# A Review of Research on National Image

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**Abstract:** National image has developed into a prominent interdisciplinary research field that examines how nations are perceived, evaluated, and represented in international contexts. Since its emergence in the mid-twentieth century, the concept has expanded from a cognitive variable in international relations to a complex construct shaped by media discourse, market mechanisms, cultural narratives, and translation practices. Drawing on representative scholarship from international relations, communication studies, marketing, imagology, and translation studies, this paper offers a comprehensive review of research on national image. It traces the conceptual origins and theoretical evolution of the field, examines its major research domains and methodological approaches, and identifies key characteristics and trends. The review argues that national image should be understood as a dynamic, multidimensional, and discursively constructed phenomenon resulting from the interaction between self-representation and external perception. By synthesizing existing research, this paper clarifies the intellectual landscape of national image studies and highlights directions for future inquiry, particularly with regard to language, media, and translation.

**Keywords:** National image; Country image; International communication; Discourse; Translation

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## 1. Introduction

In the context of intensified globalization and increasingly frequent international communication, national image has attracted sustained scholarly attention. A nation's image affects not only diplomatic relations and foreign policy decisions, but also economic cooperation, cultural exchange, tourism, and international public opinion. As international interactions are increasingly mediated through news reporting, digital platforms, and translated texts, national image has become deeply embedded in communicative and discursive processes.

Early studies in international relations demonstrated that states often act not on objective reality itself, but on their subjective perceptions of other nations, which are shaped by belief systems and symbolic representations<sup>[1]</sup>. These perceptions influence how international events are interpreted and how strategic decisions are made. With the expansion of mass media, national image gradually became linked to public opinion and media representation, as audiences came to rely heavily on mediated information to form impressions of foreign countries<sup>[2]</sup>.

Over time, research on national image has developed into a multidisciplinary and increasingly interdisciplinary field, drawing on international relations, communication studies, marketing, psychology, cultural studies, and translation studies. Scholars have approached the concept from different perspectives, emphasizing cognition, evaluation, discourse, branding, or cultural mediation. While this diversity has enriched the field, it has also resulted in conceptual ambiguity and methodological fragmentation. A systematic review is therefore necessary to clarify the conceptual foundations, theoretical evolution, and research orientations of national image studies.

This paper aims to provide such a review by synthesizing representative scholarship and tracing the development of national image research from its origins to contemporary interdisciplinary approaches. Rather than offering a simple chronological listing of studies, the paper focuses on the underlying theoretical logics, research domains, and methodological trends that have shaped the field.

## **2. Conceptual foundations of national image**

### **2.1. National image as a cognitive construct**

The concept of national image originated in the field of international relations and political psychology in the post-World War II period, when scholars began to question the assumption that states act solely on the basis of objective material conditions. One of the earliest and most influential formulations conceptualized national image as the images that nations hold of themselves and of other actors within the international system. In this sense, national image functions as a cognitive filter through which international reality is perceived, interpreted, and evaluated.

Building on this cognitive orientation, Holsti (1962) argued that national images are embedded in belief systems composed of perceived “facts” and value judgments <sup>[3]</sup>. These belief systems shape how policymakers define situations, identify threats, and formulate responses. Importantly, Holsti emphasized that such belief systems are not neutral representations of reality, but selective and interpretive constructs influenced by prior experience, ideology, and institutional context. Wright (1957) similarly highlighted that conflicts in international relations often arise not between states themselves, but between distorted images of states, underscoring the explanatory power of national image in understanding international misunderstanding and conflict escalation <sup>[4]</sup>.

From this early perspective, national image was primarily associated with elite cognition and foreign policy decision-making. The analytical focus rested on how decision-makers perceive other nations’ intentions, capabilities, and reliability, and how these perceptions influence strategic behavior. Although this approach tended to privilege political elites and state actors, it established two enduring insights: first, that national image is inherently subjective and prone to bias; and second, that perception can exert causal influence independent of objective reality. These insights provided the intellectual foundation for later research that extended the concept beyond elite cognition to broader social and communicative contexts.

The theoretical significance of this cognitive approach lies in its challenge to purely materialist explanations of international behavior. By foregrounding perception and belief, early national image research introduced psychological mediation into the analysis of international relations. This perspective implies that even accurate or improved information may fail to alter state behavior if it contradicts deeply entrenched images and belief systems. National image thus operates as a form of cognitive shortcut that reduces complexity for decision-makers, while simultaneously increasing the risk of systematic misperception. These insights would later be extended beyond elite cognition to explain broader patterns of public perception and media representation.

## 2.2. Expansion and differentiation of the concept

As national image research expanded beyond international relations, the concept underwent significant elaboration and differentiation. Scholars in communication studies, marketing, and social psychology shifted the analytical focus from elite perception to public evaluation, defining national image as the aggregate of beliefs, impressions, and evaluative judgments associated with a particular country (Martin & Eroglu, 1993). This broader definition emphasized that national image is not confined to policymakers, but is socially shared among diverse audiences.

One important line of conceptual differentiation concerns the source of national image. Researchers have distinguished between internal images held by a nation's own citizens and external images held by foreign publics<sup>[5]</sup>. These two dimensions often diverge, reflecting differences in lived experience, media exposure, and ideological positioning. Such divergence highlights the potential tension between a nation's self-perception and how it is perceived internationally, a tension that has become increasingly salient in the context of global communication.

Another significant distinction is temporal, recognizing that national image is not static but evolves over time. Scholars have identified historical images rooted in collective memory, current images shaped by contemporary events and media discourse, and future-oriented images associated with expectations and projections<sup>[6]</sup>. This temporal layering suggests that national image is accumulative and path-dependent, shaped by both continuity and change.

Furthermore, national image has been conceptualized as a multidimensional construct encompassing political, economic, cultural, social, military, and diplomatic aspects. These dimensions interact dynamically rather than existing in isolation. For example, economic success may reinforce perceptions of political competence, while cultural narratives may soften perceptions of geopolitical rivalry. Recognizing this multidimensionality has significantly complicated the task of measurement, but it has also enhanced the explanatory power of national image research.

These conceptual refinements significantly expanded the analytical scope of national image research. By distinguishing between internal and external, past and future, and multiple substantive dimensions, scholars moved away from treating national image as a monolithic perception. Instead, national image came to be understood as a layered and relational construct, varying across audiences, historical moments, and communicative contexts. While this expansion enhanced explanatory power, it also introduced methodological challenges, particularly with regard to operationalization and comparison across studies.

## 2.3. National image as a dynamic and constructed phenomenon

A major theoretical shift in national image research has been the move from viewing image as a relatively stable cognitive representation to understanding it as a dynamic and socially constructed phenomenon. From this perspective, national image is not simply discovered or perceived, but actively produced, circulated, and contested through communication.

Media discourse plays a particularly central role in this process. Through patterns of selection, framing, and repetition, media narratives foreground certain aspects of national reality while marginalizing others<sup>[7]</sup>. These discursive practices contribute to the stabilization of particular national images over time, even when they diverge from lived experience or empirical complexity. National image thus becomes embedded in recurring narratives and symbolic repertoires.

In addition to media discourse, political rhetoric, cultural production, and translation practices are key mechanisms of image construction. Translation, in particular, mediates national image across linguistic and cultural

boundaries, reshaping meaning in accordance with target audiences' expectations and interpretive frameworks <sup>[8-9]</sup>. From a constructionist perspective, national image is therefore best understood as an ongoing process of meaning-making rather than a fixed attribute of the nation itself.

From a constructionist perspective, national image should therefore be understood as an ongoing process of meaning-making rather than a fixed attribute of the nation itself. Images are continuously negotiated through discourse, shaped by power relations, institutional agendas, and cultural assumptions. This approach shifts analytical attention from the question of whether an image is "accurate" to how and why certain representations gain dominance, persistence, or legitimacy in specific communicative environments.

### **3. Development of national image research**

#### **3.1. International relations and strategic perception**

In its initial stage, national image research was closely linked to the study of international conflict and cooperation. Early scholars argued that perceptions of other nations, rather than objective conditions alone, often determine state behavior. Boulding (1959) identified images of hostility or friendliness, strength or weakness, and stability or insecurity as core variables shaping expectations and strategic interaction within the international system.

Holsti (1962) further demonstrated that these images are shaped by selective perception and cognitive bias, making them prone to distortion. Decision-makers tend to interpret new information in ways that confirm pre-existing beliefs, thereby reinforcing entrenched national images. Wright (1957) similarly emphasized that international conflicts frequently arise not between states themselves, but between distorted images of states. From this perspective, national image functions as an intervening variable between material conditions and political action.

An important contribution of this early research lies in its challenge to rationalist models of international relations that prioritize material power and objective interests. By foregrounding perception, belief, and misperception, national image research introduced a psychological dimension into the analysis of international politics. This perspective suggests that even accurate information may fail to correct distorted national images if it contradicts entrenched belief systems. As a result, national image can exert causal influence independent of material capabilities, shaping threat perception, alliance formation, and conflict escalation.

However, early international relations research on national image was largely elite-centered and state-focused. The analytical emphasis rested on policymakers and strategic decision-makers, while broader social actors and communicative processes received limited attention. The national image was treated primarily as a mental construct rather than a socially circulated discourse. This limitation would later prompt scholars to shift their attention from elite cognition to public opinion, media representation, and communicative practices.

#### **3.2. Media, communication, and public opinion**

With the expansion of mass media and the globalization of information flows, scholars increasingly turned their attention to the role of communication in shaping national image. Media organizations were identified as primary image-formers, particularly for audiences lacking direct contact with foreign societies.

Research in communication studies demonstrated that foreign news is structured by news values and framing conventions rather than by objective representativeness. Agenda-setting theory explained how media influence what audiences think about, while framing theory illuminated how media discourse shapes how events and actors



are interpreted <sup>[10]</sup>. These theoretical advances shifted national image research toward the analysis of mediated representation and public perception.

From a communication perspective, national image is produced through repeated patterns of representation that become normalized over time. Media narratives tend to privilege certain themes, actors, and evaluative frames, thereby stabilizing particular images of foreign countries in public consciousness. Once established, these images may persist even when contradicted by new events, due to the cumulative and repetitive nature of media exposure.

This communicative turn marked a decisive expansion of national image research from elite perception to mass audiences. National image was no longer conceptualized solely as a strategic variable in foreign policy, but as a discursive outcome shaped by journalistic routines, institutional ideologies, and audience interpretation. This shift laid the groundwork for later studies that integrate media analysis, discourse studies, and public opinion research into the study of national image.

**3.3 Market-oriented and branding perspective** From the late twentieth century onward, economic globalization prompted growing interest in the market implications of national image. Research in marketing demonstrated that perceptions of a country influence consumer evaluations of product quality, perceived risk, and purchasing decisions <sup>[11–12]</sup>. National image thus came to be viewed as an economic asset with tangible consequences.

These insights contributed to the emergence of nation branding studies, which conceptualize countries as symbolic entities competing for reputation in global markets <sup>[13–14]</sup>. Within this framework, national image is strategically managed through coordinated communication, branding initiatives, and international events.

Compared with earlier political and communicative approaches, market-oriented perspectives emphasize the instrumental and managerial dimensions of national image. National image is treated as a resource that can be shaped, leveraged, and evaluated in terms of economic outcomes. This approach has broadened the scope of national image research by linking perception to consumption, investment, and competitiveness.

At the same time, critics have noted that nation branding approaches risk oversimplifying complex national realities by reducing them to marketable symbols or slogans. By prioritizing strategic image management, such approaches may underplay structural inequalities, historical power relations, and ideological contestation <sup>[15]</sup>. These critiques have motivated scholars to reintroduce historical, cultural, and discursive perspectives into the analysis of national image.

## **4. Major research domains**

### **4.1. Models and functions of national image**

A central research domain concerns the development of conceptual models explaining how the national image operates. Early models focused primarily on cognitive beliefs and stereotypes, while later frameworks incorporated affective responses and behavioral intentions.

From an imagological perspective, Chew (2006) emphasized the historical and relational nature of national images, situating them within long-term power structures such as “center-periphery” and “strong-weak” relations. This approach highlights that national images are not merely individual perceptions, but culturally and historically sedimented representations shaped by asymmetric global relations.

More recent models conceptualize national image as a multi-layered construct involving cognition, emotion,

and action. These models suggest that beliefs about a country shape emotional responses, which in turn influence behavioral intentions such as purchasing, traveling, or supporting foreign policies <sup>[16]</sup>. Such integrative frameworks provide a more comprehensive explanation of how national image translates into social and political outcomes.

## **4.2. Agents and pathways of image construction**

Research has increasingly focused on the agents and pathways involved in national image construction. Governments, media organizations, cultural institutions, corporations, and individual actors all participate in shaping national images through various communicative practices <sup>[17]</sup>.

Rather than being produced by a single actor, a national image emerges from the interaction of multiple agents operating across different levels. Government-led public diplomacy initiatives may coexist with commercially driven branding campaigns and media-generated narratives, producing overlapping or even contradictory images of the same nation.

Recent studies indicate that digital platforms and social media have significantly transformed image construction processes by enabling decentralized and participatory communication <sup>[18–19]</sup>. These developments challenge traditional top-down models of national image management and call for more nuanced analyses of networked communication environments.

## **4.3. Measurement and evaluation**

The measurement of national image has long posed methodological challenges due to its abstract and multidimensional nature. Early studies relied on survey-based scales to capture cognitive evaluations of countries <sup>[20]</sup>.

Subsequent research has incorporated affective and behavioral dimensions into measurement models, offering more comprehensive frameworks for empirical analysis <sup>[21]</sup>. These models allow researchers to examine how different dimensions of national image interact and influence stakeholder behavior.

The adoption of big data and event-based datasets has further expanded methodological possibilities <sup>[22]</sup>. While these approaches enhance scale and comparability, they also raise questions regarding interpretation, context sensitivity, and the relationship between media visibility and public perception.

## **4.4. Language, culture, and translation**

An increasingly influential strand of research foregrounds language, culture, and translation as central mechanisms of national image construction. Studies in imagology and translation demonstrate that translation reshapes national images by recontextualizing discourse across linguistic and cultural boundaries.

Translation is not a neutral transfer of information, but an interpretive act involving selection, framing, and adaptation. Through lexical choices, narrative restructuring, and evaluative positioning, translation actively reconstructs national images for target audiences.

Empirical research on translated news discourse illustrates how translation mediates national image in concrete contexts. Valdeón (2016) showed how translated news contributed to constructing a new image of Spain, while Fois (2022) demonstrated how pandemic-related news translation shaped Italy's international image <sup>[23–24]</sup>. These studies highlight translation as a strategic site of image negotiation.

## **5. Characteristics and trends of national image research**

National image research exhibits several salient characteristics. It has evolved from single-discipline inquiry

to multidisciplinary expansion and interdisciplinary integration. Methodological approaches have diversified, incorporating surveys, discourse analysis, big data analytics, and experimental methods.

A notable trend is the increasing focus on the interaction between external perception and internal self-representation. Rather than treating these dimensions separately, recent research conceptualizes national image as the outcome of dynamic negotiation between hetero-construction and auto-construction.

## 6. Conclusion and future directions

This review has traced the evolution of national image research from its cognitive origins in international relations to its contemporary interdisciplinary configurations. National image emerges as a dynamic, multidimensional, and discursively constructed phenomenon shaped by communication, culture, and power relations.

Future research may benefit from greater attention to language and translation as core mechanisms of national image construction, particularly in the context of global media and digital communication. Diachronic, comparative, and corpus-based approaches can further illuminate how national images evolve across time and contexts, thereby enhancing both theoretical depth and practical relevance.

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# A Study on the Conflict Between Homebuyer Priority Rights and Mortgage Rights

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**Abstract:** Under the pre-sale system of commercial housing, homebuyers usually pay the purchase price before delivery and registration, resulting in delayed registration of ownership. When developers default or suffer capital chain disruptions, the houses are prone to seizure and judicial disposal, giving rise to conflicts of priority between consumers, mortgagees, and holders of construction project price priority rights. Through a series of judicial rules, the Supreme People's Court has established preferential protection for residential homebuyers; however, this has also brought about coordination challenges between the principle of equal treatment of creditors and the publicity of real rights. This article reviews the evolution of relevant judicial rules, analyzes the boundaries and controversies concerning the effectiveness of consumers' priority rights in excluding compulsory enforcement and claiming transfer of ownership, and proposes review approaches for special circumstances such as debt settlement by housing and secondary purchasers. Furthermore, it suggests strengthening supervision over pre-sale funds, clarifying the legal status and application conditions of consumer priority rights through legislation, and improving the dynamic disposal mechanism of mortgage rights under the framework of transfer with mortgage, so as to strike a balance between basic housing security and transaction safety.

**Keywords:** Commercial housing consumers; Priority right; Mortgage right

**Online publication:** January 30, 2026

## 1. Introduction

In pre-sale transactions, purchasers usually pay a substantial amount of the purchase price immediately after signing the contract, while the delivery of the house and registration of ownership are often delayed. As a result, when developers become involved in litigation or are subject to property preservation measures, purchasers frequently fall into difficulties in safeguarding their rights<sup>[1]</sup>. If purchasers can only claim as ordinary creditors, their repayment priority is often inferior to that of secured creditors such as mortgagees, and in extreme cases, they may suffer the loss of both money and housing. In response to such risks, Article 29 of the Provisions on Handling Objections to Enforcement and Reconsideration, Article 126 of the Minutes of the National Civil and Commercial



Trial Conference (“Jiǔ Mǐn Jì Yào”), the Reply on the Protection of Rights of Commercial Housing Consumers (“the Reply”), and the Interpretation of the Provisions on Objections to Enforcement and Reconsideration have gradually established a preferential protection framework for residential commercial housing consumers.

Based on a review of the evolution of these rules, this article focuses on substantive disputes concerning the conflict between consumer priority rights and mortgage rights, and proposes more operable institutional improvement suggestions.

## **2. Evolution of rules on the protection of commercial housing consumers**

The priority right of commercial housing consumers has undergone a process from principle-based protection to requirement-based refinement, and then to moderate expansion. As early as 2002, the Reply on Priority of Compensation clarified that consumer rights may take precedence over construction project price priority rights and mortgage rights.

The Reply of the Supreme People’s Court on Issues Concerning the Priority of Compensation for Construction Project Prices provides in Article 1 that “when trying real estate dispute cases and handling enforcement cases, the people’s courts shall, in accordance with Article 286 of the Contract Law of the People’s Republic of China, recognize that the contractor’s priority right to compensation for construction project prices shall prevail over mortgage rights and other creditor’s rights”; Article 2 further provides that “after consumers have paid all or most of the purchase price for commercial housing, the contractor’s priority right to compensation for construction project prices shall not be asserted against the purchaser.” A 2005 reply emphasized that such protection should be limited to residential purposes and should not be expansively interpreted. In 2015, Article 29 of the Provisions on Handling Objections to Enforcement and Reconsideration further clarified the review standards for excluding compulsory enforcement by specifying requirements such as the contract, purpose, and payment ratio <sup>[2]</sup>. The Minutes of the National Civil and Commercial Trial Conference in 2019 refined the interpretation of certain requirements. On April 20, 2023, the Reply once again emphasized the preferential ranking from the perspective of residential protection and adjusted the applicable conditions. Subsequently, on July 24, 2025, the Interpretation of the Provisions on Handling Objections to Enforcement and Reconsideration further clarified that improved housing should be included within the scope of protection, refined the three core requirements of “contract–payment–residential purpose”, and specified evidentiary rules and effects concerning advance notice registration and payments made through pre-sale fund supervision accounts.

Overall, the rules increasingly emphasize a combined review of “genuine residential purpose + payment capability + transaction authenticity.”

## **3. Theoretical basis of commercial housing consumers’ priority rights under current law**

The priority right of commercial housing consumers carries a strong policy-oriented character, and its legitimacy mainly derives from the following aspects.

First, in terms of hierarchy of interests, housing bears the function of basic living security, and residential interests usually rank higher in value than purely property-based secured interests <sup>[3]</sup>.

Second, from the perspective of protecting weaker parties, consumers are disadvantaged compared with developers, financial institutions, and construction enterprises in terms of information acquisition, risk control,

and utilization of institutional tools (such as advance notice registration). If handled strictly under general rules, substantive fairness would be difficult to achieve <sup>[4]</sup>. Therefore, judicial practice mitigates the concentration of risks caused by structural inequality in transactions through special protection for specific groups of homebuyers.

#### **4. Effectiveness of commercial housing consumers' priority rights and their conflict with mortgage rights**

The Provisions on Handling Objections to Enforcement and Reconsideration focus on formal review in enforcement procedures and do not automatically confirm substantive rights, while the Reply is oriented toward ensuring that residential purchasers ultimately obtain housing ownership <sup>[5]</sup>.

##### **4.1. General situations: The dispute over whether mortgage rights may be “extinguished”**

Consumers usually file objections to enforcement to exclude enforcement or bring actions requesting transfer of ownership. The core issue lies in whether a “clean transfer” is permissible.

###### **4.1.1. Mortgage rights may not be extinguished**

This view holds that priority rights mainly constitute procedural protection against enforcement, while mortgage rights are registered real security rights and should retain their right of follow and priority of compensation. Transfer of ownership may proceed through transfer with mortgage rather than mortgage cancellation. Article 406 of the Civil Code provides a legal basis for transfer with mortgage.

###### **4.1.2. Mortgage rights may be extinguished**

The opposing view emphasizes the finality of residential protection: if enforcement is merely excluded while the purchaser remains burdened with a mortgage for an extended period, the priority right would become illusory. Under strict limitations on residential purpose and payment requirements, extinguishing the mortgage may be supported to achieve unencumbered registration.

#### **4.2. Debt settlement by housing**

The key issue is whether the transferee may be recognized as a commercial housing consumer with priority over mortgage rights. Where such arrangements occur before the maturity of the underlying obligation, they are mostly of a security nature and should generally be excluded. Where they occur after maturity, the agreements are generally valid but entail risks of evasion and harm to third parties and should therefore be strictly reviewed. As a rule, priority rights do not automatically apply and may only be exceptionally granted when the residential purpose is genuine and all requirements under Article 29 of the Provisions on Handling Objections to Enforcement and Reconsideration and the Reply are strictly satisfied.

#### **4.3. Secondary purchasers**

Secondary purchasers should not be denied protection merely on the basis of being “secondary creditors.” Where the acquisition occurred prior to seizure, the residential purpose is genuine, the transaction chain and payment are clear, and statutory requirements are met, their survival risks are similar to those of original purchasers and may be included within the scope of protection.

## **5. Solutions to the conflict between commercial housing consumers' priority rights and mortgage rights**

### **5.1. Improving administrative preventive measures**

One of the practical causes of frequent conflicts is insufficient supervision over pre-sale funds, leading to misappropriation. It is necessary to strengthen special accounts and usage control for pre-sale funds and to implement mechanisms whereby sales proceeds are prioritized for repayment or deposit in credit arrangements, so as to reduce direct conflicts between mortgage enforcement and consumer rights.

### **5.2. Clarifying the legal status of commercial housing consumers**

Current preferential protection mainly relies on judicial policy rules, and its application boundaries are prone to fluctuation due to differences in adjudication standards. Legislative clarification of the scope, requirements, and effectiveness boundaries of commercial housing consumers' priority rights is necessary to form a predictable balance between residential protection and mortgage financing order <sup>[6]</sup>.

### **5.3. Establishing a dynamic handling mechanism for mortgage rights under the transfer-with-mortgage model**

Under the framework of transfer with mortgage, a phased transformation of mortgage rights from "property" to "price" may be explored. For example, sales proceeds may enter a jointly supervised account and be prioritized for loan repayment; or mortgage registration may be partially released in stages during installment repayment, thereby reducing institutional friction in consumers' acquisition of full ownership. Transparent registration of mortgage status and repayment progress may further enhance transaction predictability.

### **5.4. Future evolution of commercial housing consumers' priority rights**

The priority right of commercial housing consumers is a policy-based arrangement formed under specific social conditions, and its necessity may decline as institutions improve. With enhanced supervision of pre-sale funds and further refinement of the registration system, such priority rights may gradually return to the general framework of real rights and creditor's rights.

## **6. Conclusion**

Under China's commercial housing pre-sale system, purchasers typically assume substantial payment obligations before delivery and registration of ownership, which places them in a vulnerable position once developers fall into financial distress or enforcement proceedings. The judicial rules developed by the Supreme People's Court, including Article 29 of the Provisions on Handling Objections to Enforcement and Reconsideration, the Minutes of the National Civil and Commercial Trial Conference, and the 2023 Reply, have established a preferential protection framework for residential homebuyers by requiring a comprehensive review of contractual authenticity, payment performance, and genuine residential purpose. This approach plays an important role in safeguarding basic housing needs, yet it also creates tension with the principles of publicity of real rights and equal treatment of creditors. Looking ahead, greater emphasis should be placed on strengthening supervision of pre-sale funds, clarifying through legislation the legal nature and limits of homebuyer priority rights, and improving the handling of mortgage rights within a transfer-with-mortgage mechanism, so as to achieve a more stable balance between housing security and transactional certainty.

## Disclosure statement

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# Development Strategies for Educational Travel at Xuzhou Museum in the Background of Cultural and Tourism Integration

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**Abstract:** “Promoting tourism through culture and highlighting culture through tourism” is an important concept for promoting the integrated development of cultural tourism in the new era. Museums, rich in historical and cultural resources, serve not only as vital windows showcasing the ancient and modern aspects of a city as well as its regional characteristics, but also as indispensable educational resources for educational travel. By presenting regional cultural characteristics, museum educational travel effectively enhances students’ comprehensive qualities and fulfills its cultural and tourism educational functions. This paper discusses the development strategies for educational travel at Xuzhou Museum in the context of cultural and tourism integration, considering aspects such as the resource advantages of Xuzhou Museum, opportunities for educational travel, and challenges faced in educational travel.

**Keywords:** Cultural and tourism integration; Museums; Educational travel; Xuzhou Museum

**Online publication:** January 30, 2026

## 1. Introduction

“Culture is the soul of tourism, and tourism is the carrier of culture”<sup>[1]</sup>. Culture enriches the connotations and forms of tourism and serves as the foundation for enhancing core competitiveness. By reshaping cultural resources through tourism, people can activate culture and enhance its appeal. As a vital platform for displaying human cultural and natural heritage, museums connect a city’s past with its future, playing an irreplaceable role in exploring urban cultural heritage and disseminating regional culture. The “Guidelines on Promoting the Reform and Development of Museums” explicitly state: “We should leverage the educational functions of museums, support their participation in students’ research and practical activities, and encourage museums to become important carriers for students’ research and practice. We should optimize dissemination services and fully harness the role of museums in integrating culture and tourism and promoting cultural consumption.” Museums possess two core competitive elements: rich collections and cultural platforms<sup>[2]</sup>. Research-based travel represents a new



form of tourism transformation, combining “research-based learning with travel experiences” to cultivate students’ innovative spirit and practical abilities, serving as a new avenue for quality education for young people <sup>[3]</sup>. Better integrating museum education with school education is more conducive to preserving historical and cultural heritage and enhancing students’ comprehensive qualities. The Xuzhou Museum is a “National Research and Practice Base for Primary and Secondary School Students” and an important repository of historical and cultural heritage. Against the backdrop of integrating culture and tourism in the new era, it is particularly important to explore the resource advantages, opportunities, development status, and challenges faced by research-based travel in Xuzhou. By proposing corresponding development strategies for research-based travel, we aim to promote the sustained and healthy development of research-based travel in Xuzhou and contribute to the deepening of youth education and cultural heritage innovation.

## **2. Xuzhou Museum: Resource advantages, opportunities, and challenges in educational travel**

The Xuzhou Museum is located in Xuzhou City, Jiangsu Province, which is the birthplace of the Han Dynasty culture and boasts a profound cultural heritage of the Han era. As a national first-class museum, a national educational practice base for primary and secondary school students, a national civilized unit, a patriotism education base in Jiangsu Province and Xuzhou City, and an outstanding national base for popularizing humanities and social sciences, the Xuzhou Museum is a comprehensive institution dedicated to the excavation, display, preservation, collection, and research of historical artifacts in Xuzhou. The museum comprises four parts: the ruins of the Western Han Dynasty quarry, the Qing Dynasty Qianlong Palace, the exhibition building, and the tomb of the King of Pengcheng in the Eastern Han Dynasty. It is a comprehensive museum featuring Han culture and integrating ancient ruins, ancient architecture, and ancient tombs. The Xuzhou Museum boasts abundant resources and a complete collection system, showcasing the rich Han culture of Xuzhou and highlighting its unique historical and cultural heritage.

### **2.1. Resource advantages of the Xuzhou Museum**

#### **2.1.1. Abundant collection resources**

The Xuzhou Museum comprises four parts: the ruins of the Western Han Dynasty quarry, the Qing Dynasty Qianlong Palace, the exhibition building, and the tomb of the King of Pengcheng in the Eastern Han Dynasty. It is a comprehensive museum featuring Han culture and integrating ancient ruins, ancient architecture, and ancient tombs. The museum boasts abundant resources and a complete collection system, primarily including categories such as ceramics, jade artifacts, terracotta figurines, gold and silver artifacts, bronze and iron artifacts, seals, calligraphy and paintings, and miscellaneous items.

#### **2.1.2. Superior geographical location**

The Xuzhou Museum is situated in the heart of Xuzhou City, Jiangsu Province. Xuzhou is the birthplace of Han Dynasty culture, boasting a profound cultural heritage. Adjacent to Shandong and Anhui provinces, Xuzhou enjoys excellent transportation links, with an airport, high-speed rail, and subway system, making travel convenient by both car and public transportation. The museum is surrounded by lush, tree-lined parks, offering visitors the opportunity to take a leisurely stroll and enjoy the natural scenery after their museum visit.

## **2.2. Opportunities and advantages for study Travel at the Xuzhou Museum**

### **2.2.1. National and local policy support**

Both the national and local governments place great emphasis on study travel to museums. The state has introduced a series of policies to encourage museums to carry out educational activities, and the local government of Xuzhou also supports the Xuzhou Museum in organizing study travel programs. The Xuzhou Museum has been successfully selected as a “National Study and Practice Education Camp for Primary and Secondary School Students”, and its “Study Travel at the Xuzhou Museum” program was included in the Top 100 Cultural Heritage Tourism Cases in China for 2022. The “14th Five-Year Plan” for the development of the Xuzhou Museum proposes the implementation of a “Museum+” strategy to carry out educational and practical activities.

### **2.2.2. Access to multi-themed study and education bases**

Leveraging its advantageous resources, such as Xuzhou’s Han culture, military culture, culinary culture, and historical heritage, the Xuzhou Museum has developed a range of themed educational tourism routes, including those focused on Han culture studies, historical culture, military culture, and etiquette culture studies. These products enable young people to experience and learn through travel, to gain cognition and appreciation through real-life scenarios, and to enhance their character, willpower, and knowledge during their journeys.

## **2.3. Current status of educational travel at the Xuzhou Museum**

### **2.3.1. Diverse activity design**

The Xuzhou Museum offers a variety of educational theme activities tailored to students of different age groups, such as national defense science popularization, intangible cultural heritage lacquer fan making, and intangible cultural heritage paper cutting. These activities are not only educational but also engaging and interactive. Special courses like “Extended Classes at the Museum” and “Science Laboratories at the Museum” allow students to continue exploring and learning after school hours, broadening the boundaries of their education.

### **2.3.2. Inter-school and international collaboration**

The Xuzhou Museum collaborates with schools to conduct “Extended Classes at the Museum” activities, encouraging students to visit the museum. Activities are organized by class, with students first touring the exhibition halls and then attending academic lectures or interactive experiences in the lecture hall. Additionally, the museum has released a series of online micro-lectures, such as “The Story of Ancient Chinese Thinker Confucius” and “Chinese Seasons: The Twenty-Four Solar Terms”, which have been viewed live by primary and secondary school students in four sessions. Young people have also participated in online tours of Xuzhou’s scenic spots through the ClassIn platform. This collaborative model allows students to personally experience the charm of museums, enhancing the practicality and intuitiveness of learning. In terms of international cooperation, through exhibitions and educational activities, such as the “Immortal Jade Armor: Exquisite Cultural Relics of the Han Dynasty in China” exhibition, the diversity and inclusiveness of Chinese culture are showcased, which helps promote cultural exchange and understanding internationally.

## **2.4. Challenges faced by study tours at Xuzhou Museum**

### **2.4.1. Shortage of interdisciplinary talents in museums**

Study tour instructors are direct disseminators of culture and representatives of the museum’s image. Xuzhou Museum has mobilized its in-house commentators, educators, volunteers, experts, and scholars to participate in

the development of museum educational resources and trial lectures to refine course content. However, there is a lack of relevant professionals, such as curriculum design talents, operations management talents, and high-end planning talents, which results in many study tour services being unable to be provided normally to students. Xuzhou Museum currently lacks a dedicated study tour reception and management team and has not established a specialized study tour department, a situation that significantly adversely affects the overall quality of study tour activities.

#### **2.4.2. Insufficient new media technology**

Although the museum is equipped with various guided tour methods, including manual guided tours, online guided tours, and audio guide devices, the information content conveyed by these methods is highly similar and lacks differentiation and in-depth exploration tailored to different audience groups. During study tours, students not only expect to gain superficial knowledge of Han culture through guided tours but also yearn for in-depth interactive experiences and personalized learning paths. However, the current application of new media technologies fails to fully meet this demand, as the content of guided tours lacks sufficient appeal and educational depth, thereby limiting students' study tour experiences. Additionally, the Xuzhou Museum falls short in its promotion and outreach on new media platforms, failing to fully leverage emerging channels such as social media and short videos to expand its influence. As a result, public awareness and engagement with the museum remain low.

#### **2.4.3. Safety concerns**

Study tours at museums are typical group activities specifically designed for students, a unique demographic, making it crucial to ensure the safety of such events. However, the study tours at the Xuzhou Museum are still in their infancy, with many aspects requiring optimization, including the provision of professional guidance, rational allocation of personnel, improvement of hardware facilities, establishment of a safety management system, and formulation of emergency response plans.

#### **2.4.4. Lack of study tour routes**

The Xuzhou Museum, as a repository of rich historical and cultural resources, holds immense potential for study tours. However, it currently faces a significant challenge in the form of a lack of diverse study tour routes. The limited number of routes primarily focuses on in-museum exhibit displays and explanations, lacking diversity and depth, and failing to meet the diverse needs of teachers and students. The design lacks innovation, with fixed procedures that struggle to stimulate students' interest. Furthermore, the museum has not fully utilized the resources of the surrounding scenic spots and lacks joint development with other cultural sites, thereby limiting the breadth and depth of study tour activities.

#### **2.4.5. Lack of a sound market mechanism for museum-based educational travel**

In the process of fulfilling its cultural and educational functions, Xuzhou Museum employs relatively monotonous promotional methods, resulting in low popularity among contemporary students and limiting the development and value realization of its educational travel programs. Therefore, Xuzhou Museum needs to actively innovate, expand its promotional channels, and fully leverage internet marketing tools to attract more visitors to gain a deeper understanding of its historical and cultural essence. As a public welfare museum, Xuzhou Museum faces a contradiction between public welfare and commercialism in educational travel, lacking a sound market mechanism for such travel. This contradiction makes it difficult to allocate benefits reasonably and hinders the standardized

development of educational travel at Xuzhou Museum. It is necessary to implement more standardized management and establish a sound market mechanism for educational travel at Xuzhou Museum to achieve a balance between public welfare and commercialism.

### **3. Development strategies for educational travel at Xuzhou Museum in the context of cultural and tourism integration**

#### **3.1. Cultivating educational travel talents and enhancing professional guidance**

Cultivating talents for educational travel, especially in the field of museum-based educational travel, is a comprehensive task that integrates tourism, education, and professional skills, requiring the cultivation of compound talents with multifaceted abilities and knowledge. In response to the challenges faced by Xuzhou Museum in cultivating educational travel talents, it should focus on enhancing participants' cultural literacy and deepening their understanding of culture and its connotations. Xuzhou Museum needs to establish close cooperative relationships with schools, educational institutions, etc., to jointly construct a talent cultivation system for educational travel. This collaboration should transcend traditional knowledge transmission and instead focus on the cultivation of practical abilities. Through joint research and learning activities between schools and museums, future research and learning instructors can learn in practice how to integrate cultural and tourism elements, innovate interpretation and presentation methods, and convey the cultural connotations of museums more vividly and engagingly. During the cultivation process, emphasis should also be placed on a deep understanding of culture and its connotations. As an important vehicle for cultural inheritance and display, museums' research and learning activities should not only showcase cultural relics themselves but also uncover their historical backgrounds, cultural connotations, and social values. Therefore, research and learning instructors need to possess rich historical and cultural knowledge, enabling them to guide students in delving deeply into the stories behind cultural relics, experiencing the charm of culture, and enhancing their cultural literacy. To improve the quality and effectiveness of research and learning trips, Xuzhou Museum should actively recruit and cultivate talents in curriculum design, operations management, and high-end planning to refine the service system for research and learning trips. These individuals should not only possess solid professional knowledge but also innovative thinking and practical abilities, enabling them to design targeted research and learning courses and activities based on the needs of different schools and students, ensuring that research and learning trips are both enjoyable and educational. Museums and schools should jointly explore the establishment of a "dual-qualified" teaching staff, comprising teachers who possess both teaching abilities and the capacity to lead research and learning activities. The construction of such a teaching staff facilitates the deep integration of education and tourism, allowing students to both acquire knowledge and enjoy the pleasures of travel during research and learning trips, thereby comprehensively enhancing their cultural literacy and overall abilities.

#### **3.2. New media technologies enhance the experiential aspect of educational travel**

Traditional educational travel methods, such as conventional visits and lectures, often lack sufficient appeal. New media technologies offer opportunities for innovative development in this area. Museums can leverage cutting-edge technologies like VR (Virtual Reality) and AR (Augmented Reality) to deeply digitize their collections and create immersive educational experiences. These technologies not only build emotional bridges between cultural artifacts and audiences through multidimensional elements such as color, sound, and imagery, allowing viewers to feel as if they are traveling through time and engaging in profound dialogues with the artifacts, but they also fully



mobilize the emotions and thoughts of the audience, enabling them to explore history and understand the cultural connotations behind the artifacts through a blend of learning and play. Through new media technologies, museums can vividly and intuitively present the historical stories, craftsmanship techniques, and social contexts behind cultural artifacts to the audience, allowing them to gain a deeper understanding of the cultural values and spiritual pursuits embodied in these artifacts while appreciating them, thereby enhancing their cultural literacy.

### **3.3. Collaborate with multiple parties to establish a long-term cooperation mechanism**

Educational travel is an off-campus educational model where schools organize students to travel collectively for study purposes. Given the characteristics of students' ages and mental development, as well as the unique nature of organizing educational travel, ensuring students' safety is of utmost importance during such trips, in addition to providing for their dietary needs, rest, and education. Study travel involves multiple entities, including the government, schools, society, travel agencies, and study travel bases. The process of study travel requires support from various departments such as education, culture and tourism, public security, transportation, market supervision, emergency management, and fire protection. To ensure the smooth progress of study travel, different entities involved should share resources and collaborate closely. It is essential to establish a long-term cooperation mechanism involving multiple parties, with the education administrative department taking the lead, schools responsible for instructional design, museums responsible for introducing their collection resources, and study travel institutions responsible for organization and route development. On the basis of cooperation, the rights and responsibilities of each party should be defined. In strict accordance with industry standards and considering the situation of study travel in Jiangsu Province, unified implementation standards, evaluation mechanisms, laws and regulations, and supervision systems for study travel should be formulated to form a joint supervisory force and strengthen the organizational leadership and supervision of the study travel process.

### **3.4. Integrate resources from multiple sources to create high-quality study travel routes**

Currently, many study travel bases in Xuzhou seldom actively cooperate to achieve large-scale and clustered development. To create high-quality study travel routes centered around the Xuzhou Museum, the government can take the lead in planning, while each study travel base actively seeks cross-sectoral cooperation to integrate study travel resources in Xuzhou and create systematic and international study travel routes. Regarding the positioning of the Han Culture Research and Study Base at the Xuzhou Museum, it can collaborate with nearby sites such as Xima Terrace and Hubu Hill to develop practical research and study themes. Additionally, it can integrate with premium research and study routes. For the historical positioning of the Xuzhou Museum, it can form a research and study route centered on patriotism education and historical and cultural education in conjunction with the Huaihai Campaign Memorial Hall research and study base. The Xuzhou Museum, along with the Xuzhou Folk Museum, the Huaihai Campaign Memorial Hall, and other research and tourism bases, can be linked together to enable visitors to experience ancient culture, intangible cultural heritage, and revolutionary (red) tourism all at once, achieving a diverse cultural tourism experience. It can also collaborate with other research and study bases to create distinctive "museum+" research and travel itineraries with different themes.

### **3.5. Establish and improve the market mechanism for museum research and travel**

In the context of cultural and tourism integration, the market for museum research and travel presents development opportunities. As an important vehicle for cultural heritage, museum research and travel projects are not merely



about displaying artifacts and historical events but also about interpreting and disseminating the profound cultural connotations behind them, making them a significant force in the future cultural and tourism market <sup>[4]</sup>. In terms of marketing strategies, the Xuzhou Museum's research and travel market should fully leverage a combination of online and offline approaches to achieve precise marketing. Firstly, the museum's research and travel programs should utilize internet technology to achieve precise resource matching, catering to the unique needs of different participants. For example, establish a dedicated section for educational travel, regularly release relevant information, and provide participation links. Meanwhile, build an information service platform that integrates cultural tourism and actively promotes educational travel projects through emerging media channels such as Xiaohongshu and Weibo. Offline, the museum organizes various experiential activities, such as knowledge lectures and handicraft-making sessions, allowing participants to personally experience the charm of culture and deepen their understanding of its connotations. Additionally, Xuzhou Museum needs to strengthen close cooperation with various stakeholders by entrusting sales to social partners such as educational institutions and travel agencies, enabling the museum itself to focus more on its core functions of social education and cultural dissemination.

## 4. Conclusion

In the context of the integration of culture and tourism, Xuzhou Museum still needs improvement in terms of educational travel. The development of educational travel at Xuzhou Museum requires the joint efforts and support of the entire society. By implementing strategies such as strengthening talent cultivation, creating high-quality educational travel routes, and improving the market mechanism for museum educational travel, people can not only promote the standardized and professional development of educational travel at Xuzhou Museum but also provide teenagers with richer and more diverse educational travel experiences, fostering the inheritance and innovative development of history and culture.

## Disclosure statement

The author declares no conflict of interest.

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# Research on the Administrative Efficiency of Township Cadres — Taking the Protection of Basic Farmland in X Town as an Example

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**Abstract:** The key subject of grassroots policy implementation is township cadres, whose administrative efficiency can have a significant impact on the effectiveness of national governance. In the process of implementing the basic farmland protection policy, various factors combined with personal motives such as risk aversion and interest balance will have an effect on the performance of duties of township cadres, such as avoiding the contradictions of people's livelihood and selectively performing tasks, leading to deviation in policy implementation and tension between cadres and the masses, such as avoiding contradictions related to people's livelihood and selectively executing tasks, resulting in deviations in policy implementation and tension between cadres and the masses. Based on the theory of power-responsibility relationship, taking X Town as an example, this paper uses the methods of literature analysis and in-depth interviews to explore the influencing factors and correction path of the performance effect of township cadres.

**Keywords:** Township cadres; Administrative efficiency; Basic farmland protection

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## 1. Introduction

### 1.1. Background

The Third Plenary Session of the 20th CPC Central Committee showed that, in terms of the national governance system and governance capacity building, the grass-roots government is the cornerstone of national governance and the fundamental project to achieve the modernization of the national governance system and governance capacity, and grass-roots governance is the most dynamic in the field of national governance. It is the closest to the masses and the deepest integration into life. It is the “face-to-face” governance with the broad participation of the masses. The key executors of the basic farmland protection policy are township cadres. The implementation of this policy can ensure the food production capacity, so as to make the “Chinese rice bowl” more secure, curb the “non-agricultural” and “non-grain” of cultivated land, maintain the ecological balance, promote the

intensive development of agriculture, and promote the revitalization of rural areas. This paper aims to study the administrative efficiency of township cadres in the protection of basic farmland, and put forward countermeasures and feasible suggestions to solve the problem.

## **1.2. Literature review**

### **1.2.1. Definition of administrative efficiency**

With regard to the quantification of local government efficiency, the research group of “China’s local government efficiency research”, composed of experts from Beijing Normal University and Jiangxi Normal University, will issue the “China’s local government efficiency research report” every year from 2010 to 2019. The impact factors include four categories: government public services, government size, government openness, and residents’ economic welfare. The standardized value of local government efficiency in 31 provinces, autonomous regions, and municipalities in China is calculated <sup>[1]</sup>. Government efficiency was originally called administrative efficiency, which originated from Wilson’s famous work “Research on Administration” in 1887. It pointed out that “the purpose of research on administration is how the government performs its duties efficiently.” It was first defined that administrative efficiency is to achieve the highest efficiency at the lowest cost <sup>[2]</sup>. Hindy (2007) believes that efficiency is the maximization of the ratio of output to input or the ratio of results to resources, which is the only standard for evaluating administrative performance in the classical period <sup>[3]</sup>. Chenxiaoling and Lixiaoqing (2013) elaborated that government efficiency is manifested in the benefits and effects of the government in providing public services to the public, effectively eliminating market failures, promoting sustainable economic development, and maintaining social equity <sup>[4]</sup>.

### **1.2.2. Measures to improve the performance efficiency of township cadres**

Establish and improve the fault tolerance and error correction system, and encourage cadres to be bold in innovation and responsibility. People should strengthen the exchange of cadres in rotation, education and training, broaden the vision of cadres, and improve their professional quality and innovation ability <sup>[5]</sup>. To promote the development of China’s agricultural economy, the relevant governments should improve their efficiency. To do this, first of all, people should improve the relevant management system, pay attention to the cultivation and improvement of the comprehensive quality of the relevant management personnel <sup>[6]</sup>. Only by establishing a strong concept of efficiency can people attach importance to and try to improve efficiency, and there can be a situation of vitality and vigor in work. People must make the administrative staff continue to establish the concept of efficiency and improve work efficiency through training <sup>[7]</sup>. The essence of service-oriented government is “social standard, citizen standard.” As the personnel who exercise the state administrative power and perform the state public affairs, civil servants are also the image spokespersons of the government. Whether their quality and ability are good or not is closely related to the quality of the government’s public service supply, and also directly affects the government’s credibility <sup>[8]</sup>. In essence, administration is still inseparable from people, and there is no administration without people. Therefore, the most important thing to improve the efficiency of administration is to improve the quality of staff, that is, to establish a high-quality and excellent administrative management talent team <sup>[9]</sup>. The fundamental way to solve the problem of government efficiency is to effectively improve the government’s execution and credibility <sup>[10]</sup>.

## 2. Analysis of the administrative efficiency of township cadres in basic farmland protection in X Town: Content analysis of interviews with township cadres in X Town

In order to deeply analyze the administrative efficiency of township cadres in the implementation of basic farmland protection policy, unstructured interviews were conducted with two township cadres in different positions in X Town to explore their work difficulties and needs from multiple perspectives. Before the interview, an interview outline was formulated around key issues such as policy implementation cognition, resource allocation, rights and responsibilities, and assessment pressure to ensure that the content of the interview was comprehensive and focused on research topics. The main contents of the interview are shown in **Table 1**.

**Table 1.** Interview content

Respondent number	Position	Interview content
1	Office director	The main content of the interview was the conflict between the policy and people's livelihood in the implementation of the policy.
2	Head of the law enforcement department	The interview mainly focused on unreasonable assessment pressure.

## 3. Research on influencing factors of administrative efficiency of township cadres in X Town

### 3.1. Complex administrative process

The administrative process in the basic farmland protection policy is complex and lengthy, which is easy to affect the effect of performing duties. When the basic farmland has been changed for use, illegally occupied, and other violations, township cadres need to deal with it. According to laws and regulations, the masses are required to hand in a number of necessary materials, such as land ownership certificates, agricultural production planning, and so on, and the authenticity and compliance of the materials are verified. However, the verification work involves multiple departments and needs to be approved by different levels of government. The short time the materials are submitted for approval is weeks or months, and the poor information communication between departments and the existence of information islands will also make the process repeated, ultimately affecting the administrative efficiency.

### 3.2. The diverse demands of the masses

In the protection of basic farmland, the diversified demands of the masses are often placed in front of the work of township cadres. With the improvement of the awareness of protecting the rights of the masses, demands for the protection of basic farmland are increasing, including illegal land occupation reports, land ownership disputes, and other issues. However, the demands of the masses are numerous and complex, and the township cadres are unable to take care of everything due to the constraints of human resources, time, and other resources.

### 3.3. Imbalance of rights and responsibilities

The “administrative contract awarding system” essentially belongs to an organization type of intermediate form, which is a mixture of bureaucracy and outsourcing<sup>[10]</sup>. China is a unitary country. The current administrative system is the system of the combination of Parliament and administration under the leadership of the Communist Party of China. Horizontally, the highest organ of state power is the National People's Congress, and the Communist Party of China is the core of leadership of the Chinese government. All functional departments of

the government are in charge of social affairs and perform their respective duties. Vertically, the power of policy-making lies in the central government, and local governments exercise decision-making power according to the guidance of the central government and the policies and legal procedures formulated by the central government.

### **3.4. Financial power and administrative power do not match**

In China, the basic pattern of administrative power is formed by the joint management of governments at all levels under the institutional framework, and the administrative power of local governments is the refinement and expansion of the power of higher-level governments. As the most grass-roots organization of the national governance system, township cadres are the subject of specific policy implementation and the service subject directly facing the masses, so they have heavy responsibilities and busy work. Township governments' financial power is reduced, their powers are expanded, and there are fewer resources and more affairs. However, the sinking of affairs has led to the downward shift of responsibility, while resources and power have not been correspondingly empowered. Grass-roots cadres are at the end of the pressure-type system chain, and the power is limited and responsible behavior.

The protection of basic farmland is a red line and a hard indicator. The responsibilities undertaken at the township level tend to expand, but on the contrary, they are not given corresponding powers. The county-level government has complete powers, while the administrative law enforcement functions and powers at the township level are not sufficient <sup>[11]</sup>.

## **4. Corrective measures for township cadres' evasion behavior**

### **4.1. Improving the incentive mechanism for township cadres**

People should improve the performance appraisal mechanism with the results of basic farmland protection as the core, take the data of cultivated land ownership and illegal land use rectification rate as the evaluation criteria, and form the evaluation criteria with local characteristics in combination with the people's satisfaction with the protection of basic farmland and the topography and geomorphology of local basic farmland distribution; A special incentive fund for the protection of basic farmland at the provincial, municipal and county levels should be established to give material rewards such as bonuses and subsidies to township cadres who have made outstanding performance in the protection of basic farmland.

### **4.2. Strengthen the training of township cadres and improve their comprehensive ability**

The township cadres should strengthen their understanding of relevant laws and regulations. Combined with the typical cases of basic farmland protection in recent years, the common misunderstandings and key points in policy implementation should be analyzed. By simulating the disposal process of cases of illegal occupation of cultivated land, the township cadres should grasp the whole process from on-site evidence collection, document delivery, case filing and investigation to judicial transfer; Regularly carry out policy update training, timely convey the latest requirements of the central government on the regulation of "non-agricultural" and "non grain" cultivated land, help cadres accurately grasp the work scale, and prevent anomie and shirking responsibility due to insufficient understanding of the policy.

### **4.3. Optimize the assessment scheme for township cadres**

Officials will improve the multidimensional evaluation system for township cadres, include indicators such as



people's satisfaction, the success rate of conflict mediation, and the coverage of policy publicity into the core assessment category, build a satisfaction survey platform combining online and offline, and quantify people's satisfaction with the implementation of policies and cadre services through regular anonymous questionnaires and household interviews; Improve the accounts of contradictions and disputes, and dynamically track the mediation efficiency and success rate of land ownership disputes and complaints about illegal land use.

## 5. Conclusion

Research has shown that the administrative efficiency of township cadres will ultimately be affected by various reasons. In the new stage of grass-roots governance modernization, we need to constantly improve the assessment, responsibility, incentive, and other systems according to the actual situation of grass-roots governance in China, so as to better safeguard the interests of the people, shape a good government image, and further build a service-oriented government.

## Disclosure statement

The author declares no conflict of interest.

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# The Impact of Internet Use on the Subjective Age of Older Adults: A Cross-Sectional Empirical Study

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**Abstract:** Subjective age, referring to an individual's self-perception of aging, serves as a significant indicator of active aging. Against the backdrop of population aging and the increasing digital engagement of older adults, examining how internet use influences subjective age carries important contemporary relevance for promoting active aging. Drawing on data from the 2020 China Longitudinal Aging Social Survey (CLASS), this study employs ordinary least squares (OLS) regression to demonstrate that internet use exerts a significant negative effect on subjective age among older adults, meaning that internet users report feeling younger than their non-user counterparts. Furthermore, through stepwise regression, the study confirms the mediating roles of occupational engagement and social adaptation in the relationship between internet use and subjective age. These findings highlight the need to accelerate the development of an age-friendly digital ecosystem with supportive institutional frameworks, lower barriers to internet access, and foster a younger subjective age among older adults, thereby contributing to the proactive response to population aging.

**Keywords:** Internet use; Subjective age; Older adults

**Online publication:** January 30, 2026

## 1. Background

Population aging has become a major social phenomenon that countries worldwide cannot overlook. As a country with a large population, China has experienced an accelerated aging process in recent years, with the proportion of older adults in the total population continuing to rise. This trend poses unprecedented challenges to China's economic and social development. In this context, issues related to active aging have become a focus of attention across various sectors of Chinese society. Within the aging process, subjective age—as a key indicator of active aging—holds greater predictive value for individual development and socialization among older adults compared to chronological age. Therefore, an in-depth exploration of the factors influencing subjective age in older adults not only represents an effective pathway for implementing active aging strategies but also constitutes an important

direction for theoretical inquiry.

Alongside the accelerated digital transformation of society, internet adoption among older adults has been increasing. Compared to younger groups, older adults generally start using the internet later in life. Digital engagement, represented by internet use, has opened new practical avenues for China's national strategy to address population aging. However, research in this area remains in its early stages in China. There is still a lack of systematic and in-depth exploration regarding the mechanisms through which internet use affects subjective age in older adults, as well as potential variations across different demographic groups.

Therefore, using data from the 2020 China Longitudinal Aging Social Survey (CLASS2020), this study examines the current state of subjective age among older adults and investigates the impact of internet use on subjective age. It further explores variations in this mechanism across different groups and analyzes the mediating roles of social adaptation and occupational engagement in the relationship between internet use and subjective age.

## **2. Literature review and research hypotheses**

### **2.1. The concept and status of subjective age**

Subjective age typically refers to the age an individual perceives and identifies with. It represents a person's subjective assessment of their own chronological age and serves as a key indicator for measuring individual development in later life, correlating with numerous markers of successful aging <sup>[1]</sup>. It reflects an individual's subjective feelings about aging and age-related processes <sup>[2]</sup>. Compared to chronological age, subjective age carries greater social, psychological, and cultural significance <sup>[3]</sup>. Research on subjective age in Chinese academia started relatively late and remains limited. Studies are primarily concentrated in fields such as psychology, gerontology, and sociology, mainly focusing on older adults, with little exploration of other age groups.

Existing research indicates variations in subjective age across different age groups. Most adolescents perceive themselves as older than their chronological age, while most adults in early adulthood feel younger than their actual age <sup>[4]</sup>. Older adults, in the later stages of life, typically report a subjective age younger than their chronological age. The discrepancy between chronological and subjective age becomes more pronounced with advancing age among older adults <sup>[5]</sup>. Chinese older adults generally report a subjective age lower than their chronological age, although notably, the gap between actual and subjective age is smaller among Chinese seniors compared to other populations <sup>[6-7]</sup>.

### **2.2. The impact of internet use, occupational engagement, and social adaptation on subjective age among older adults**

Internet use reshapes older adults' perception and identification with their own age through multiple pathways, finding that internet use significantly reduces the subjective age of older adults, with moderate users reporting an average subjective age 1.5 years younger. Wang et al. further indicated that internet use lowers subjective age by enhancing sense of social worth, improving self-rated health, increasing instrumental activity capacity, and alleviating depressive symptoms <sup>[8]</sup>. Qiu and Zhou suggested that deeper engagement and embeddedness in internet use among older adults more readily fosters positive perceptions of aging, with this effect being particularly pronounced among rural, younger-old, and unpartnered older adults <sup>[9]</sup>. Zhang et al. proposed that internet use helps older adults establish positive perceived age, felt age, and aging age, and that men are more likely than women to develop a positive subjective age under the influence of internet use <sup>[10]</sup>.

Therefore, this study proposes:

H1: Internet use has a significant negative effect on the subjective age of older adults.

The subjective age of older adults is influenced by social participation. Social engagement can lead older adults to perceive themselves as younger. Higher frequency and greater diversity of participation are associated with a lower subjective age. Engaging in grandchild care may also contribute to a reduced subjective age<sup>[11]</sup>. In the Chinese context, Cheng & Jiang both concluded that a higher degree of social participation is associated with a younger subjective age among older adults<sup>[12]</sup>. Wang et al. emphasized that moderate social participation, including occupational and economic engagement, positively influences older adults' subjective age identity<sup>[8]</sup>.

Research on the impact of social adaptation on subjective age is limited. Lu and Zhang suggested that the level of social adaptation effectively promotes social participation among older adults, thereby contributing to the construction of a positive subjective age<sup>[13]</sup>. Zhang et al. pointed out that social adaptation plays a mediating role in the relationships between internet use and perceived age, felt age, and aging age, indirectly affecting subjective age through social adaptation<sup>[10]</sup>.

Therefore, this study proposes:

H2: Occupational engagement mediates the relationship between internet use and the subjective age of older adults.

H3: Social adaptation mediates the relationship between internet use and the subjective age of older adults.

### 3. Methods

#### 3.1. Data sources

The data used in this study were drawn from the 2020 China Longitudinal Aging Social Survey (CLASS2020), which employed a multistage stratified sampling design. The original survey comprises 11,398 respondents aged 60 and above. It includes measures of internet use, occupational engagement, social adaptation, subjective age, and other relevant variables. To ensure consistency in sample size across all variables, cases with missing values on the variables included in this analysis were removed. The final analytical sample consists of 9,406 older adults.

#### 3.2. Variable definition

Drawing on previous studies examining factors influencing subjective age among older adults, this study includes individual characteristics, economic characteristics, and health characteristics as control variables. See **Table 1** for details.

**Table 1.** Variable definition

Variables	Definition	Mean±SD
Subjective age	Continuous variable [range: -45, 35]	-3.06±6.39
Internet use	No = 0; Yes = 1	0.29±0.45
Occupational engagement	Not engaged = 0; Engaged = 1	0.24±0.42
Social adaptation	Scale score obtained by summing relevant items	25.19±7.13
Chronological age	60–74 = 1; 75–89 = 2; 90 and above = 3	1.29±0.47
Gender	Female = 0; Male = 1	0.51±0.50
Hukou	Agricultural = 0; Non-agricultural = 1	0.48±0.50

**Table 1 (Continued)**

Variables	Definition	Mean±SD
Marital status	Without spouse = 0; With spouse = 1	0.754±0.43
Education	Primary or below = 1; Junior high = 2; Senior high or above = 3	1.48±0.69
Personal annual income	0–1,000 yuan = 1; 1,001–5,000 yuan = 2; 5,001–10,000 yuan = 3; 10,001 yuan and above = 4	1.80±1.09
Pension insurance	No = 0; Yes = 1	0.78±0.42
Self-rated economic status	Worse = 1; Similar = 2; Better = 3	2.07±0.53
Number of chronic diseases	Scale score obtained by summing relevant items	1.79±1.46
Self-rated health status	Unhealthy = 1; Fair = 2; Healthy = 3	2.34±0.72
Mental health	Scale score obtained by summing relevant items	19.92±3.60

### 3.3. Econometric equation

Consistent with the measurement level of the explanatory variables, this study employs an ordinary least squares (OLS) regression model to analyze the impact of internet use on the subjective age of older adults, using SPSS 26.0. The econometric equation is specified as follows:

$$SA = \alpha + \beta_{iu} + \gamma_{control} + \varepsilon$$

where SA represents the subjective age of older adults,  $iu$  denotes internet use, control refers to the set of control variables included in the analysis,  $\alpha$  is the constant term,  $\beta$  and  $\gamma$  are the regression coefficients for internet use and the control variables, respectively, and  $\varepsilon$  denotes the error term.

## 4. Results

### 4.1. Baseline regression analysis, robustness checks, and heterogeneity analysis

Model 1, which included only the control variables, shows that the model as a whole is statistically significant. Specifically, regarding individual characteristics, the regression coefficients for the age groups 75–89 and 90+ are significantly negative, indicating that older seniors report a younger subjective age. Older adults with non-agricultural household registration also report a younger subjective age. Among economic characteristics, participation in pension insurance and self-rated economic status both have a significant positive effect on subjective age. For health characteristics, the number of chronic diseases, self-rated health status, and mental health significantly influence subjective age: a higher number of chronic diseases and poorer self-rated health and mental health are associated with an older subjective age. Model 2 introduces the core explanatory variable, internet use, while retaining the control variables. The model remains statistically significant overall, with the adjusted  $R^2$  increasing to 0.058, indicating improved explanatory power compared to Model 1. Internet use has a significant negative effect on the subjective age of older adults, meaning that older adults who use the internet report feeling younger than their chronological age compared to those who do not use the internet.



**Table 2.** Baseline regression analysis (OLS)

Variables	Subjective age	
	Model 1	Model 2
Internet use		-0.758*** (-4.618)
Controls	Yes	Yes
constant term	-2.449*** (-5.201)	-2.549*** (-5.415)
Adj.R <sup>2</sup>	0.056	0.058
Samples	9406	9406

\*\*\*  $P < 0.001$ ; \*\*  $P < 0.01$

Furthermore, robustness checks were conducted using variable substitution. Specifically, chronological age and personal annual income were transformed from categorical to continuous variables, and the baseline regression model was re-estimated. The adjusted  $R^2$  after substitution increased compared to the original model, and the negative effect of internet use on subjective age remained statistically significant at the 1% level ( $\beta = -1.091$ ,  $t = -6.687$ ). These results confirm the reliability of the baseline regression findings, supporting Research Hypothesis.

To further explore the heterogeneous effects of internet use on subjective age across different groups, subgroup analyses were performed based on residence area, gender, and educational attainment.

Regarding residence area, compared to urban older adults who do not use the internet, those who use the internet report a subjective age that is significantly younger by 0.833 years ( $t = -4.022$ ,  $P < 0.001$ ). In terms of gender, the negative effect of internet use on subjective age is significantly stronger among women than among men ( $P < 0.001$ ), with the absolute value of the regression coefficient for women approximately 1.65 times that for men ( $\beta_1 = -0.962$ ,  $\beta_2 = -0.584$ ;  $t_1 = -3.950$ ,  $t_2 = -2.624$ ).

In summary, internet use has a significant negative effect on the subjective age of older adults. Older adults who use the internet report a significantly younger subjective age compared to those who do not.

## 4.2. Examination of the underlying mechanisms

To investigate the internal mechanisms through which internet use influences the subjective age of older adults, this study employs Baron and Kenny's causal steps approach to construct separate mediation models for occupational engagement and social adaptation. PROCESS (Model 4) was used to test the significance and type of the mediation effects, calculate the proportion of the indirect effects, and analyze the mechanistic roles of occupational engagement and social adaptation.

As shown in **Table 3**, after controlling for the study's covariates, Model 3 indicates that internet use has a significant negative effect on the subjective age of older adults. Model 4 shows that internet use has a significant positive effect on occupational engagement, meaning that older adults who use the internet report higher levels of occupational engagement. Model 5 shows that after including both internet use and occupational engagement, the negative effect of internet use on subjective age remains significant at the 1% level, and occupational engagement exhibits a significant positive predictive effect on subjective age—higher occupational engagement is associated with an older subjective age. Model 6 indicates that internet use has a significant positive effect on social

adaptation, meaning that internet users report significantly higher levels of social adaptation. Model 7 shows that after including social adaptation, the direct effect of internet use on subjective age remains significant at the 1% level, while social adaptation has a significant negative predictive effect on subjective age—higher social adaptation is associated with a younger perceived subjective age. Hypotheses 2 and 3 are preliminarily supported.

**Table 3.** Examination of the underlying mechanisms

Variables	Subjective age	Occupational engagement	Subjective age	Social adaptation	Subjective age
	Model 3	Model 4	Model 5	Model 6	Model 7
Internet use	-0.758*** (-4.618)	0.041*** (4.112)	-0.782*** (-4.766)	0.585** (3.119)	-0.716*** (-4.377)
Occupational engagement			0.594*** (3.520)		
Social adaptation					-0.071*** (-7.899)
Controls	Yes	Yes	Yes	Yes	Yes
constant term	-2.549*** (-5.415)	0.231*** (8.014)	-2.686*** (-5.690)	23.334*** (43.326)	-0.892 (-1.735)
Adj.R <sup>2</sup>	0.058	0.201	0.059	0.010	0.064
Samples	9406	9406	9406	9406	9406

\*\*\*  $P < 0.001$ ; \*\*  $P < 0.01$

## 5. Conclusions

The proportion of internet use among older adults remains relatively low. Their subjective age tends to be younger than their chronological age, with an average difference of approximately three years. Internet use exerts a significant negative effect on the subjective age of older adults; those who use the internet report a significantly younger subjective age compared to non-users. This study employed multiple linear regression analysis and conducted robustness checks using variable substitution, confirming that the negative impact of internet use on subjective age is robust. Furthermore, heterogeneity tests based on residence area, gender, and educational attainment revealed that the effect of internet use on subjective age is more pronounced among urban older adults and older women.

Both occupational engagement and social adaptation play partial mediating roles in the relationship between internet use and subjective age. Using stepwise regression, this study found that internet use has a significant positive effect on occupational engagement. Older adults who use the internet show higher levels of occupational engagement than non-users, while occupational engagement itself has a significant positive effect on subjective age. The indirect effect of internet use on subjective age through occupational engagement is significant, accounting for 3.298% of the total effect and demonstrating a suppression effect. Simultaneously, internet use has a significant positive effect on social adaptation, whereas social adaptation has a significant negative effect on subjective age. Social adaptation serves as a significant negative mediator between internet use and subjective age, accounting for 5.541% of the total effect, indicating a partial mediation role.

## Disclosure statement

The author declares no conflict of interest.

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# A Study on the Evolution of Urban Sports Spirit under the Influence of Tianjin-style Culture

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**Abstract:** The urban sports spirit is a key element of urban temperament and an important aspect as well as a symbolic representation of urban culture. This paper takes the timeline of over four decades since the reform and opening-up as a starting point and uses Tianjin as a case study to analyze the “evolution” of the urban sports spirit nurtured by Jin-style culture. It explores the development and evolution of the urban sports spirit under the influence of reform and opening-up from the perspectives of time measurement and theoretical analysis. The research indicates that the shaping of Tianjin’s sports spirit requires and, in turn, nurtures: the accumulation of sports economic development, a solid material foundation of sports venues, the enhancement of citizens’ comprehensive sports literacy, and comprehensive government services. The direction of its mature transformation lies in adapting to new contradictory environments and deeply integrating with the spirit of Tianjin.

**Keywords:** Tianjin-style culture; Urban sports spirit; Reform and opening-up

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## 1. Introduction

The urban sports spirit represents vitality and dynamism for a city’s development, comprehensively reflecting the common pursuits, beliefs, ethos, cohesion, and other aspects of a city. It is also a comprehensive manifestation of a city’s traditional sports culture, architectural style of sports facilities, and the overall sports quality of its citizens, including their sports values, level of civilization, mental outlook, and ideological and moral standards. On the whole, the urban sports spirit is a concentrated expression of the spirit inherent in a city’s economy, politics, culture, ecology, and sports. The progress and development of urban sports cannot be separated from the driving force of the sports spirit. As an important component of the national sports spirit, it possesses diverse characteristics such as tradition, modernity, integrity, and consciousness. The urban sports spirit not only exhibits diverse characteristics but also serves multiple functions, including guiding, cohesive, encouraging, critical, and radiating functions. Similar to the evaluation of the development of things in Marxist

philosophy, the urban spirit is also dynamic rather than static. In times of peace, without the integration of the sports spirit, the development of a city lacks a soul. Since the reform and opening-up, the urban sports spirit has undergone tremendous changes alongside the growth and advancement of cities. This paper takes the “evolution” of the urban sports spirit in Tianjin as the research object, analyzing it based on the timeline of the past forty years of reform and opening-up, and examines the transformation of the Tianjin urban sports spirit nurtured by Jin-style culture.

## **2. Overview of Jin-style Culture and the Connotation of Urban Sports Spirit**

### **2.1. Jin-style Culture**

“The confluence of the Luyu and Wei rivers leads to the sea, and the scenery of Dinggu has long been renowned.” The unique geographical location and special historical circumstances have shaped the growth and development of Tianjin city, and have also accumulated a profound and distinctive Jin-style culture<sup>[1]</sup>. Regional culture is an integral part of Chinese civilization, and deepening research on Tianjin’s regional culture, grasping its main developmental trajectory and cultural core through its diverse and multi-layered external characteristics, is a foundational project for promoting cultural inheritance and development and showcasing the confidence in Chinese cultural theory<sup>[2-3]</sup>. Tracing back to the Neolithic Age, there were already people inhabiting the Tianjin area. During the Ming Dynasty, when the Prince of Yan, Zhu Di, crossed the river southward from here and successfully ascended to the throne, he bestowed the name Tianjin upon this place and established a garrison here, thus giving rise to Tianjin Wei. Tianjin’s geographical location as a “confluence of rivers and the sea” and its historical circumstances of opening up in modern times, along with the population migration brought about by its position as “a vital junction of nine rivers and a thoroughfare for seven provinces’ boats and carriages”, have resulted in a social structure characterized by “a mix of people from all directions and a blend of the north and south.” This, in turn, has fostered the unique characteristics of Jin-style culture through the fusion of local culture, immigrant culture, and Western culture<sup>[4]</sup>. Specifically, this is manifested in four aspects:

- (1) A combination of elegance and popularity in cultural forms. The cultural expressions of Jin-style culture not only exhibit a vertical community distribution resulting from the pace of historical development (from ancient to modern times) but also feature an aesthetic clash between elegance and popularity within the mainstream cultural environment. Especially under the influence of modern concession culture, the fusion of ancient and modern, tradition and modernity, and the East and the West has created an atmosphere in Tianjin that is both elegant and close to popular culture. This has endowed Jin-style culture with the characteristics of seeking common ground while preserving differences and harmonious coexistence.
- (2) A coexistence of transfer and absorption in the form of inheritance. Jin-style culture has a distinct community state and a dock culture characterized by welcoming and bidding farewell, which, to a certain extent, affects the firmness of the development of Jin-style culture’s roots. Jin-style culture has its own origins, but much of its flourishing development is attributed to cultures from outside its region, indicating a lack of prominent leading figures and a large local team in Jin-style mainstream culture. Meanwhile, Tianjin has always served as a granary transport port, with a significant transfer personality in welcoming and bidding farewell. However, as Tianjin’s urban functions have become increasingly powerful, it has continuously demonstrated strong cohesion and attraction, facilitating the absorption of



“other” cultures by Jin-style culture and making it a unique cultural characteristic. Jin-style culture is vibrant and diverse, constantly “transferring” and full of vitality.

- (3) A combination of gaps and diversity in interactive exchanges. The community nature of Jin-style culture is relatively pronounced, a result of historical sedimentation. Due to this, there are certain gaps between communities and the diversity of immigrant cultures, making the Tianjin region significant in seeking common ground while preserving differences.
- (4) Mutual promotion of creativity and symbiosis in ecological development. Jin-style culture exhibits a state of diversified development, prompting the enhancement of its grafting and creative abilities, further forming and aggregating the city’s core strength. Cultural activities in the city’s later stages become more revolutionary, and the city’s style becomes more stable and open-minded. On the other hand, it also reflects the strong receptive ability of Jin-style culture, using its innovative spirit to change people’s lives. In summary, Jin-style culture has a profound heritage, gradually forming and accumulating over the course of history. It is the spiritual birthplace of the Tianjin region and an important symbol that distinguishes it from other regional cultures. For every citizen of Tianjin, Jin-style culture is a vivid carrier of their cultural identity.

## **2.2. Connotation of urban sports spirit**

The connotation of urban sports spirit reflects a deeper level of social consciousness, which can be summarized into two aspects, both centered around the city. One aspect pertains to the cultural form of sports, while the other relates to sports spirit phenomena associated with the city. The integration of these two aspects embodies the connotation of a city’s sports spirit <sup>[5]</sup>. Specifically, it can encompass urban sports culture, architectural styles, and the comprehensive sports literacy of citizens (including value orientations, levels of civilization, spiritual outlooks, and ideological and moral standards). The urban sports spirit serves as the soul of a city’s development; without the support of sports spirit, a city lacks the inherent vitality and momentum for growth. It is an inevitable outcome of the development of urban sports civilization, representing the core content of urban sports civilization with distinct urban sports characteristics. It embodies the essence of a city’s economy, politics, culture, and sports. The value orientation of urban sports spirit reflects the spiritual and cultural values of the city and represents the direction of its development. Urban sports spirit represents not just a city, but also serves as a pillar of the powerful sports spirit of a nation and a driving force for the development of sports endeavors.

## **3. The “evolution” of urban sports spirit in Jin-Gu culture during the reform and opening-up process**

The reform and opening-up policy, decided upon at the Third Plenary Session of the Eleventh Central Committee of the Communist Party of China in December 1978, marked a historic turning point for China’s development. It initiated a comprehensive effort towards socialist modernization, setting China on the path of reform and opening-up. As one of the first coastal cities to open up under this policy, Tianjin, under the correct leadership of the municipal party committee and government, has continuously pursued innovation and deepened reforms, achieving remarkable success in various fields. Among these achievements, the sports sector has also flourished since the reform and opening-up, reflecting Tianjin’s unique urban sports spirit.

### 3.1. Construction of a large number of sports facilities

Since the reform and opening-up, the Tianjin government has renovated and expanded a significant number of sports venues and facilities. Looking back at Tianjin's historical development process, the 1950s marked the first peak period for the construction and development of sports venues and facilities in the city. The second peak came during the 1980s, following the reform and opening-up, when four training bases and specialized venues for various sports were built at sports colleges and universities. Leveraging the opportunity to host the 43rd World Table Tennis Championships, Tianjin completed the nation's first indoor track and field competition venue, significantly transforming the backward situation of sports venue construction in the city and playing a crucial role in promoting the development of Tianjin's sports culture and international exchanges. With the upgrading of sports venues in terms of scale and quality, venues such as the Tianjin Tennis Center, Tianjin Baseball Field, and Diving Platform have taken leading positions domestically. Since the 21st century, with the acceleration of modernization, Tianjin has actively developed urban sports venues and facilities, comprehensively enhancing the city's carrying capacity and promoting further development of the sports sector. Notably, the Tianjin Olympic Sports Center served as a venue for the 2007 FIFA Women's World Cup and the 2008 Beijing Olympics<sup>[6]</sup>. To meet the demands of hosting these events, many first-class competition venues have been constructed. For instance, during the 13th National Games hosted by Tianjin in 2017, venues for various sports events were readily available, ensuring a perfect conclusion to the games. Over the past 40 years of reform and opening-up, Tianjin's construction of a large number of sports venues and vigorous development of the sports sector have undeniably integrated the sports spirit well into urban cultural construction, enhancing citizens' cohesion and the city's influence.

### 3.2. Hosting of sports events

Since the reform and opening-up, alongside the construction of a large number of sports venues in Tianjin, some significant sports events have also been held in the city with great enthusiasm (**Table 1**). The World Table Tennis Championships were held in 1995, followed by the World Gymnastics Championships in 1999 and the Women's Water Polo World Cup in 2006. After the successful hosting of these international competitions, Tianjin secured the right to host the 6th East Asian Games in 2007. In the same year, the Tianjin women's volleyball team achieved a remarkable "five consecutive championships" in the National Women's Volleyball League, while the Tianjin women's football team also excelled, winning both the National Women's Football Association Cup and the Super League, dubbed the "double crown." Since the reform and opening-up, Tianjin has achieved commendable results in competitive sports, greatly encouraging citizens' enthusiasm for participating in sports and promoting the integration of sports spirit with urban spirit. On August 16, 2011, Tianjin successfully obtained the right to host the 13th National Games of China in 2017, becoming the fourth province or municipality to host the National Games after Jiangsu, Shandong, and Liaoning, following the central government's decision to end the monopoly of Beijing, Shanghai, and Guangdong. Since the reform and opening-up, Tianjin's overall strength has continuously risen, equipping it with the capability to host events. It is committed to making the 13th National Games a more people-friendly and beneficial event, perfectly aligning with the Games' philosophy of "National Games for All, Benefiting All through the National Games." The inclusion of mass events highlights the comprehensive characteristics of Jin-Gu culture, which appreciates both elegance and popularity and embraces diversity, allowing the general public to fully immerse themselves in the healthy, joyful, and passionate atmosphere brought by the National Games. It also underscores Tianjin's

unique urban sports spirit that combines sports as a platform, economic exchanges, and cultural prosperity.

**Table 1.** Overview of competitive sports events hosted by Tianjin since the reform and opening-up

Hosting Time	Event Name	Results and Achievements
1995	World Table Tennis Championships	A turning point for the Chinese table tennis team from a low point to strength and prosperity
1999	34th World Artistic Gymnastics Championships	China's first time hosting an international gymnastics event; won four gold medals in men's team, men's rings, men's vault, and women's balance beam, opening a new chapter for Chinese competitive gymnastics
2006	Women's Water Polo World Cup	The Chinese team finished eighth despite having home advantage
2008	Co-host City for the Beijing Olympics	The "Water Drop" Sports Center completed; significant improvements in urban development and social civilization
2009	FIBA Asia Championship	As the birthplace of Chinese basketball, it demonstrated the spirit of the Nankai Five Tigers
2012	9th National University Games	Comprehensive completion of the Haihe Education Park
2013	East Asian Games	The concept of hosting events frugally aligned with the city's ecological civilization development approach
2015	Asian Women's Volleyball Cup	Embodied the spirit of the Tianjin women's volleyball team
2017	13th National Games of China	Reflected the philosophy of "Games for All, Benefits for All" and showcased a more open and inclusive sports spirit

### 3.3. Development of large-scale mass fitness activities

After the reform and opening-up, various social undertakings in Tianjin entered a stage of leapfrog development. The healthy and orderly development of sports undertakings encompasses not only competitive sports but also mass sports work, with Tianjin consistently maintaining a leading position nationwide in this regard. During the early years of reform and opening-up in the 1980s, fresh foreign elements continuously flowed into China, bringing about profound changes across the country, and Tianjin was no exception, experiencing numerous "firsts" in the development of its social undertakings <sup>[7]</sup>. With the improvement of Tianjin's economic level, the living standards of its people also rose accordingly, and sports undertakings were no longer confined to competitive sports. Mass sports activities characterized by fitness and leisure sprouted up like mushrooms after rain.

By 2002, Tianjin had over 4,000 sports venues of various categories, most of which were open to the public, providing places for ball games, swimming, fitness, and other recreational and sports activities during holidays and leisure time. Tianjin pioneered the nationwide "Holiday Sports" large-scale mass fitness activities, and in 2005, the State General Administration of Sport praised Tianjin for its leading position in mass sports activities nationwide. The overall pass rate of national physical fitness monitoring in Tianjin exceeded the national average, indicating a strong momentum in the development of fitness-for-all initiatives. With the deepening of reform and opening-up, sports undertakings developed rapidly, and Tianjin took the lead in other cities in terms of management level and concepts in conducting large-scale mass activities, walking at the forefront of the country. This was directly related to the establishment of community sports venues and community sports clubs, in line with the requirements of China's "National Fitness Program Outline", and reflecting a strong urban sports spirit of fitness-for-all. As institutional reforms continued to deepen and the market economy became increasingly sound, relevant sports departments in Tianjin actively promoted mass

fitness activities in this environment, responding to the national call to build healthy cities. The Tianjin Fitness-for-All Activity Center has always adhered to the guiding principles of “public welfare, professionalism, health, and science”, serving public health and providing Tianjin residents with a variety of fitness programs, with mass fitness activities keeping pace with reform. Meanwhile, various enterprises also actively participated in the development of mass fitness activities in Tianjin. For example, the “Tianjin Urban Joy Run” hosted by Vanke in 2018 won the favor and active participation of Tianjin residents and various enterprises and institutions, jointly experiencing the wonderful achievements brought about by 40 years of reform and opening-up.

### **3.4. Mature sports park culture**

For a city, parks are public shared spaces with public welfare characteristics, belonging to the city’s green and environmentally friendly infrastructure. They are also concentrated green spaces that improve the regional ecological environment, providing places for the public to play, appreciate, and rest. From the perspective of cultural dissemination functions, park culture can also reflect certain spiritual characteristics of the city, showcasing urban culture and the spirit of the times, and even becoming a spiritual symbol of urban development. In the wheel of historical development, Tianjin is a city that is both ancient and young, having experienced over 600 years of vicissitudes<sup>[8]</sup>. As one of the earlier port cities to open up in China, Tianjin has formed a unique Jinghu culture, which also means that the growth process of Jinghu culture has been very torturous. By grasping the development (context/history) of Tianjin and delving into the essence of Jinghu culture during the process of reform and opening-up, Tianjin’s park culture has gradually integrated into urban sports construction, reflecting the city’s symbolic personality and sports spirit.

Tianjin, as a northern city, exhibits a diversified trend in the development of sports forms, with sports parks being the most prominent feature. This is very suitable for the northern region and is also an innovation. With the continuous deepening of reform and opening-up, sports parks have been uniformly standardized in the later stages. The development and improvement process of Minyuan Stadium, which has a history of over a hundred years, is a typical representative of the standardized management of sports parks in Tianjin. In 2012, Tianjin’s first sports park, the Hedong Sports Fitness Park, was opened to the public, receiving high attention and praise from Tianjin residents, who considered it a significant initiative to promote fitness-for-all. Over more than 40 years since the beginning of reform and opening-up, the nature of parks in Tianjin has gradually evolved from initially providing places for residents to visit and play to serving both leisure and fitness purposes, with upgraded models. Sports parks have been built in various districts of Tianjin, stimulating residents’ interest and enthusiasm in participating in sports activities and spreading the urban sports spirit everywhere.

## **4. Countermeasure analysis on the shaping and development of urban sports spirit**

### **4.1. Comprehensively develop the sports economy to lay a solid material foundation for promoting the construction of urban sports spirit**

From a conceptual perspective, urban sports spirit belongs to the realm of ideology and superstructure, and its important foundation for development lies in the sports economy. For the development of urban sports spirit, the sports economy serves as a crucial material foundation, driving the prosperity and development of urban sports spirit and comprehensively reflecting the sports spirit of a city. The development of the urban sports economy and urban sports spirit has a dialectical relationship; without the support of material production in the sports economy, a series of display activities of sports spirit would not be formed. For a city to possess mature and



perfect sports, spiritual, and material civilizations, it must have material production activities. Therefore, the first priority is to develop the sports economy and improve the consumption levels and living quality of urban residents. As a national central city and comprehensive transportation hub, Tianjin must adhere to the common laws of urban development to maintain the sustained prosperity and development of its sports economy. It should identify innovative growth points for Tianjin's development, improve the layout of the sports industry, further promote the sustainable growth of Tianjin's urban sports economy, and provide impetus for promoting and shaping the construction of Tianjin's modern urban sports spirit.

#### **4.2. Enhancing the comprehensive sports literacy of Tianjin citizens and laying the mass foundation for urban sports spirit**

The construction of urban sports spirit not only requires the assistance of a sports economic foundation but also necessitates a strong foundation of the people to be realized and implemented. Tianjin boasts a vast population base, with an equally significant number of floating residents. In recent years, Tianjin has hosted an increasing number of large-scale sports events, particularly the successful hosting of the 13th National Games in 2017, which opened its doors wider, leading to a gradual increase in both floating and foreign populations. People with diverse cultural backgrounds, customs, and languages have gathered in this city, injecting fresh vitality into Tianjin while personally experiencing the fruits of its flourishing sports sector amidst reform and opening-up<sup>[9]</sup>. The people of Tianjin are not only participants in the construction of the city's sports spirit but also sharers in the benefits of its sports endeavors. Therefore, the sports literacy of citizens directly impacts the construction of urban sports spirit, making the enhancement of the comprehensive sports literacy of Tianjin citizens fundamentally crucial for shaping the city's sports spirit.

#### **4.3. The public service system serves as a guarantee for the construction of an urban sports spirit**

The process of constructing a city's sports spirit is highly complex, encompassing not only sports civilization, material civilization, and political civilization but also ecological construction civilization within the city<sup>[10]</sup>. If the government can provide strong organization and management during this process, supported by a well-established public service system, it will significantly bolster the construction and development of the city's sports spirit, akin to adding wings to a tiger. This will facilitate coordination between citizens and the construction of sports spirit, guiding citizens to form positive sports behaviors. The roles played by governments at all levels in Tianjin in the complex (systematic project) of constructing urban sports spirit should primarily be that of public servants, avoiding superficial efforts and focusing on the construction and implementation of the connotations of sports spirit. This will promote the synchronous construction, development, and reform of Tianjin's urban sports spirit.

### **5. Postscript**

The shaping of Tianjin's urban sports spirit requires and, in turn, nurtures: the accumulation of sports economic development, a solid material foundation of sports venues, the enhancement of citizens' comprehensive sports literacy, supply-side reform of sports public services, and comprehensive government services. The profound Jin-style culture has always been interwoven throughout the development trajectory of Tianjin, becoming its unique characteristic. With the continuous deepening of reform and opening-up, Tianjin's urban sports spirit



has undergone tremendous changes accordingly. How to continuously seek the transformation of its spiritual essence amidst the shift in the primary contradictions of social development in the new era, as well as how to deeply integrate with the Tianjin spirit of “patriotism, integrity, pragmatism, innovation, openness, and inclusiveness” in the new era, will be the directions for the continued maturation of Tianjin’s urban sports spirit.

## Disclosure statement

The author declares no conflict of interest.

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# Research on the Construction and Application of Talent Competitiveness Model in the Field of Philosophy and Social Sciences in “Double First-Class” Universities

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**Abstract:** Based on the talent development in the field of philosophy and social sciences in “Double First-Class” universities, this study systematically analyzes the dilemmas and opportunities they face in terms of disciplinary attributes, disciplinary characteristics, the new technological revolution, and global disciplinary adjustments. The study constructs a competitiveness model covering factors such as consolidating academic foundation, innovating academic viewpoints, adhering to the principle of “connecting the top and grounding the foundation”, seizing strategic positions, contributing to teaching and talent cultivation, and making sustained policy contributions. On this basis, the study puts forward cultivation suggestions. The research aims to provide a theoretical framework and practical reference for “Double First-Class” universities to enhance talent competitiveness in the field of philosophy and social sciences.

**Keywords:** Double First-Class universities; Philosophy and social sciences; Talent competitiveness

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## 1. Introduction

The development of philosophy and social sciences in China has entered a new stage of connotative prosperity from the reconstruction of disciplinary systems. The country and universities have deepened their understanding of its positioning and practical role, and entrusted it with a more important mission <sup>[1]</sup>. The “Education Power Construction Plan Outline (2024–2035)” emphasizes its national status <sup>[2]</sup>. Therefore, in-depth research on the competitiveness model framework and the generation logic of talents in this field has important theoretical and practical value. The model will scientifically, systematically, and comprehensively evaluate and measure the core elements and comprehensive capabilities of talents, and on this basis, put forward systematic and implementable cultivation suggestions, so as to provide a theoretical basis and practical guidance for universities

in discovering, selecting, introducing, cultivating, using, and evaluating talents. The significance of the research is reflected in two aspects: on the one hand, at the theoretical level, constructing a scientific and systematic model helps to clarify the relationship between the basic support and key elements of talent growth and development, and enriches and deepens the existing talent development theories. On the other hand, at the practical level, exploring scientific cultivation measures has direct reference value for promoting the optimization of university talent work mechanisms and enhancing the comprehensive competitiveness of talents <sup>[3]</sup>.

This study adopts the literature research method to systematically sort out relevant theories and research published by scholars at home and abroad, laying a research foundation. At the same time, combined with the case comparative analysis method, it analyzes representative universities and teachers to ensure the scientificity, systematicness, and persuasiveness of the research conclusions.

## **2. Literature review: Research status at home and abroad**

At present, domestic and foreign research on talents in philosophy and social sciences has formed a certain foundation. Domestic research mainly focuses on three aspects: first, evaluation research on specific disciplines or high-level potential talents <sup>[4]</sup>. For example, Xiao Mingzheng and Ye Jiyuan discussed the key influencing factors in the talent growth process and the “comprehensive evaluation” system <sup>[4]</sup>. Second, empirical research on specific regions. For example, Zhao Yanwen analyzed the problems existing in the current talent classification evaluation system, such as vague evaluation standards and single evaluation dimensions, and put forward suggestions <sup>[4]</sup>. Yang Xi took some universities in Guangxi as the research object, pointed out that local universities have problems such as emphasizing the quantity of papers over quality and academic achievements over social services in the evaluation mechanism of philosophy and social sciences teachers, and proposed that a more scientific and reasonable evaluation system should be constructed to help the all-round development of talents <sup>[4]</sup>. Third, exploring the optimization path of the talent evaluation mechanism from specific perspectives, such as big data <sup>[4]</sup>. Cao Yue proposed that in the context of big data, the subject, content, and method of talent evaluation should be rethought <sup>[4]</sup>. Although international research is mostly based on disciplinary development, its evaluation concepts emphasizing academic freedom, long-term accumulation, and social influence are worthy of reference. For example, the evaluation system of European and American universities emphasizes long-term accumulation and multi-dimensional investigation.

However, there are still many research gaps and problems to be solved in existing research and practical exploration. First, there is a lack of a competitiveness model constructed based on multi-dimensional indicators, which is difficult to fully reflect the comprehensive competitiveness of talents in terms of academic ability, innovation ability, social service ability, and international perspective. Second, the research on the training path and growth mechanism of talents in this field is relatively weak, especially in the discovery, selection, incentive, and support of high-level innovative talents; there is still a lack of operable and promotable system design. Third, the international training path for talents in this field has not yet formed a systematic mechanism, and talents have limited opportunities for international exchanges, cooperative research, overseas visits and studies. Fourth, the docking mechanism between talents in this field and local economic and social development is not perfect, leading to structural contradictions between talents and social needs <sup>[5]</sup>. Fifth, the construction of research bases and think tank platforms for philosophy and social sciences in universities is still in its initial stage, lacking landmark achievements with wide influence and decision-making reference value <sup>[6]</sup>.

### **3. Core concepts related to talents in the field of philosophy and social sciences in “Double First-Class” universities**

“Double First-Class” is a major national strategy aimed at promoting the construction of world-class universities and first-class disciplines. In February 2022, the state issued the “Several Opinions on Further Promoting the Construction of World-Class Universities and First-Class Disciplines”, and the new round of construction was officially launched, emphasizing the promotion of the construction of the philosophy and social sciences system and promoting the integration of interdisciplinary disciplines <sup>[7]</sup>.

In this paper, “talents in philosophy and social sciences” refer to professional personnel engaged in teaching and research work in this field and related interdisciplinary disciplines in universities. They shoulder the mission of talent cultivation, scientific research, academic innovation, and value guidance. Universities gather more than 80% of the national social science forces and are an important force in China’s philosophy and social sciences <sup>[8]</sup>. By the end of 2021, the team of philosophy and social sciences in Chinese universities had a total of 897,000 people <sup>[9]</sup>.

“Talent competitiveness” refers to the comprehensive quality and ability shown by talents in competition, and its core lies in the effective integration and coordination of multiple abilities <sup>[10]</sup>. The “talent competitiveness model” is a systematic sorting and structural expression of competitiveness elements. By constructing a scientific evaluation system including multiple dimensions such as basic knowledge, talent cultivation, scientific research, team building, social service, and international exchange, it reveals the inherent laws of talent growth and development and provides support for cultivation.

### **4. Current dilemmas and era opportunities for talent development in the field of philosophy and social sciences in “Double First-Class” universities**

#### **4.1. Analysis of practical dilemmas**

##### **4.1.1. Dilemma of the disciplinary attributes of philosophy and social sciences**

Philosophy and social sciences possess the characteristics of “non-standardization”, “long-term effectiveness of achievements”, and “criticality.” Scholars engaged in basic and long-cycle research are at a disadvantage in competition. For instance, the impact of major theoretical breakthroughs or ideological enlightenment often takes decades or even a century to fully manifest. In 2024, 53.1% of the Nobel laureates in Economics first published their key research findings before 1969, making the Nobel Prize in Economics a highly “lagging” award <sup>[11]</sup>.

##### **4.1.2. Dilemma of technological revolution impact**

The technological revolution represented by artificial intelligence and big data is impacting philosophy and social sciences in an unprecedented way. First, new technologies have reshaped research paradigms and methods. While big data analysis improves research efficiency and expands research boundaries, it also challenges traditional methods centered on speculation and qualitative analysis. For example, the chat robot ChatGPT has become popular, which can write papers, code, and create novels, triggering a heated discussion on whether artificial intelligence can replace human uniqueness <sup>[12]</sup>. Second, the technological wave has exacerbated the contradiction in the talent ability structure: compound talents who are proficient in both professional knowledge and digital skills are extremely scarce, while scholars who stick to traditional methods are facing the risk of “surplus capacity.” The rapid development and wide application of digital technology and

artificial intelligence have accelerated the transfer of human labor from traditional physical and mental work to highly creative and high-value-added jobs, and some repetitive and procedural tasks have been quickly replaced by digital technology <sup>[13]</sup>.

#### **4.1.3. Global decline and subversive adjustment of traditional philosophy and social sciences disciplines**

Under the dual impact of the reshaping of the global knowledge pattern and the digital wave, traditional philosophy and social sciences disciplines are experiencing a global decline in influence and in-depth adjustment. Their resource allocation and status have been squeezed. Some European and American universities are facing the shrinking of humanities disciplines and are integrating into interdisciplinary fields. In December 2020, the College of Arts and Sciences of the University of Vermont proposed to cut 23 undergraduate majors in the humanities. In October 2024, the Harvard University newspaper “The Crimson” published news that more than 30 autumn courses were canceled, with the History and Literature Department canceling the most courses <sup>[14]</sup>. In recent years, domestic universities have also carried out new disciplinary adjustments, obviously tending to strengthen science and engineering disciplines and reduce liberal arts, which is particularly evident in “Double First-Class” universities <sup>[15]</sup>.

#### **4.1.4. Dilemma of the development of philosophy and social sciences disciplines in universities**

Within universities, philosophy and social sciences disciplines are facing the dual dilemmas of implicit achievement transformation and marginalized resource allocation. Their contributions are mostly ideological, cultural and policy influence, which are difficult to directly quantify and monetize like scientific and technological achievements, resulting in their often being in a weak position in social cognition and internal university resource allocation. China is currently in a critical period of realizing a strong science and technology country. The country’s demand for fields such as AI and bioengineering has prompted universities to increase investment in science and engineering. This trend is not unique to China; many countries around the world are increasing investment in science and engineering <sup>[15]</sup>.

### **4.2. Discussion on era opportunities**

#### **4.2.1. The original mission of philosophy and social sciences has always centered on the core goal of building a community with a shared future for mankind**

Globally, the fundamental value of philosophy and social sciences lies in responding to the major strategic needs of national and civilized development. National and civilized development urgently needs philosophy and social sciences to provide in-depth intellectual support. This requires and encourages talents in philosophy and social sciences to root their academic research in the fertile soil of development practice, so as to gain profound value recognition. In November 2020, the “Declaration on the Construction of New Liberal Arts” was released, emphasizing that the construction of new liberal arts not only affects liberal arts itself, science, engineering, agriculture and medical education, but also the overall higher education, and proposed resource inclination support <sup>[16]</sup>.

#### **4.2.2. Opportunity for the innovation of philosophy and social sciences in the technological era**

Digital technology is not a replacement but an empowerment. New paradigms such as “computational humanities”, “social physics”, and generative AI have emerged, which can assist scholars to free themselves



from repetitive labor, improve research efficiency, and help them focus on higher-level innovation.

#### **4.2.3. Opportunity for disciplinary transformation brought by subversive changes**

Global subversive changes are promoting profound paradigm transformation of philosophy and social sciences and opening up new development paths. The function of philosophy and social sciences is shifting from “explaining the world” to “shaping the future.” In global issues such as digital governance and scientific and technological ethics, they have become core participants in rule design and value definition. The unprecedented trend of interdisciplinary integration highlights their “practical value.”

#### **4.2.4. Opportunities for the development of philosophy and social sciences disciplines in universities**

In recent years, universities have continuously carried out mechanism reforms, optimized scientific research management, promoted interdisciplinary integration, improved evaluation systems, and encouraged original and cutting-edge research, creating a good environment for the prosperity and development of philosophy and social sciences<sup>[17]</sup>. On March 1, 2025, the first domestic “The Future is Here — Blue Book on the Intelligent Development of Humanities and Social Sciences” compiled by Fudan University was released, marking a new starting point for the intelligent development of humanities and social sciences. It will attract more scholars to pay attention to the in-depth integration of artificial intelligence and humanities and social sciences, and promote the acceleration of new liberal arts innovation<sup>[18]</sup>.

### **5. Construction of talent competitiveness model in the field of philosophy and social sciences in “Double First-Class” universities**

#### **5.1. Theoretical basis and analysis framework of the talent competitiveness model**

This study constructs an analysis framework based on four core theories. The human capital theory, an economic theory proposed by American economists Theodore Schultz and Gary Becker, emphasizes capital investment through education and training to improve individual productivity and social benefits, with educational investment regarded as the core element<sup>[19]</sup>. It provides the core concept for this study to focus on the cultivation path of talents’ internal ability construction and sustainable development.

The competitiveness theory originated from David Ricardo’s theory of comparative advantage of production factors. In 1990, Prahalad and Hamel formally proposed the core competitiveness theory<sup>[20]</sup>. The competitiveness theory, especially Michael Porter’s “Diamond Model”, provides a paradigm for the systematic analysis of the sources of competitiveness<sup>[21]</sup>. Adapting it to this field, competitiveness can be decomposed into: factor conditions, demand conditions, hard resources, and soft resources, which lays the framework foundation for constructing a structured model.

The academic ecosystem theory places talent growth in a dynamic system composed of institutions, culture, resources, etc., emphasizing the energy exchange and symbiosis between individuals and the environment<sup>[22]</sup>. This suggests to this study that the improvement of competitiveness not only depends on personal endowments but also requires the construction of a sound academic ecological support.

Knowledge management is the latest management thought and method emerging in the era of the knowledge economy. It integrates modern information technology, knowledge economy theory, enterprise management thought and modern management concepts. This theory focuses on the process of knowledge

creation, sharing and application, and analyzes how talents build core competitiveness through systematically integrating and internalizing knowledge (consolidating the foundation), creating new knowledge (academic innovation), using intelligent tools (AI empowerment) and explicit dissemination (representative works) from the mechanism level, which runs through the key links of talent development<sup>[23]</sup>.

## **5.2. Construction principles of the talent competitiveness model**

### **5.2.1. “Double First-Class” strategic orientation principle**

The model closely follows the national “Double First-Class” construction goals and takes serving the construction of the national philosophy and social sciences discipline system as the fundamental starting point. The design of competitiveness elements and the selection of observation indicators are all aimed at guiding talents to produce original and leading achievements, and ultimately serving the improvement of the overall strength of universities.

### **5.2.2. Disciplinary characteristic adaptation principle**

The model fully responds to the inherent characteristics of knowledge production in philosophy and social sciences, such as “non-standardization”, long-term benefit and “criticality” of value. In terms of evaluation dimensions, it emphasizes qualitative evaluation such as representative works, academic ideas and social influence; in terms of development orientation, it encourages dedicated research of “polishing a sword for ten years” and reserves space for non-consensus and interdisciplinary exploratory research.

### **5.2.3. Systematic ecological symbiosis principle**

Drawing on the academic ecosystem theory, the model regards talent competitiveness as the result of the interaction between individuals and environmental elements such as institutions, culture and resources. Therefore, the model focuses on the process of energy exchange and coordinated evolution between the individual “competitiveness” of talents and the external academic ecology, forming a virtuous cycle of mutual promotion between “talent growth” and “ecological optimization.”

### **5.2.4. Dynamic practical application principle**

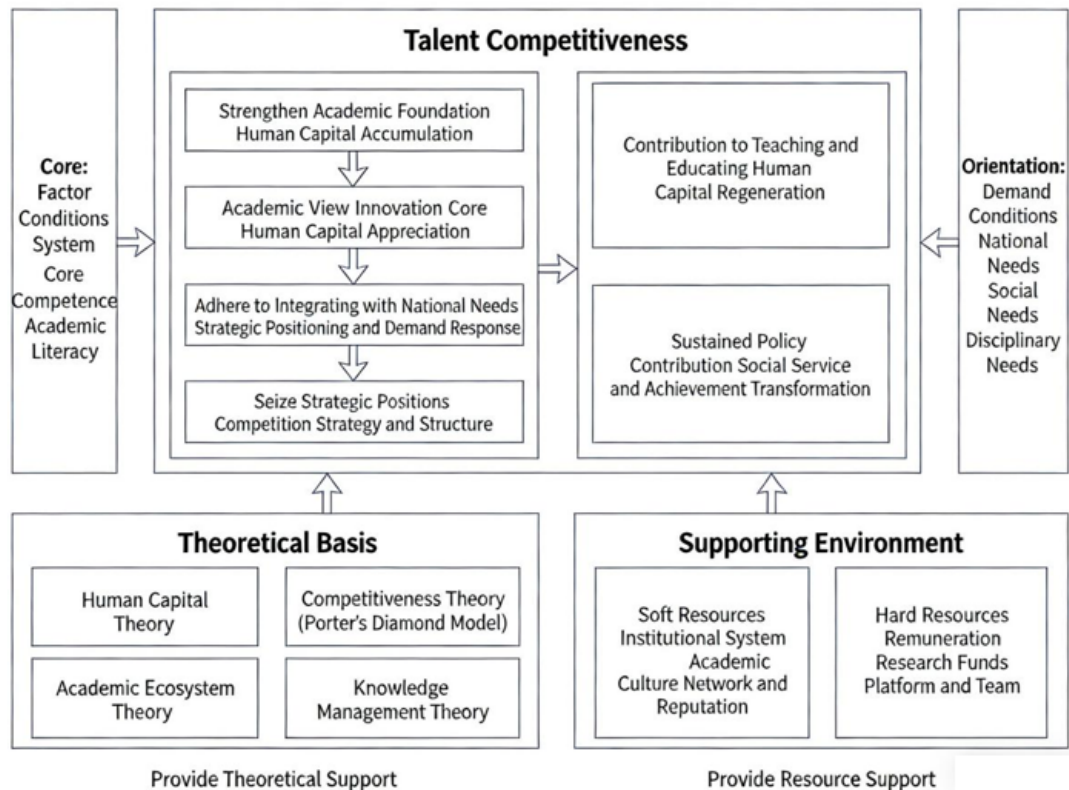
The model adheres to the problem-oriented and practical-oriented approach, and its elements and indicators are derived from the response to practical dilemmas and era opportunities (such as the inclusion of “AI collaborative empowerment”). The model is open and can be dynamically adjusted according to technological changes, policy adjustments and disciplinary development, aiming to provide a directly referable and applicable systematic framework for universities’ talent introduction and cultivation, evaluation and incentive, and resource allocation.

## **5.3. Construction of the talent competitiveness model**

### **5.3.1. Consolidating academic foundation**

A solid academic foundation is the cornerstone of talents’ sustainable development (**Figure 1**). This requires talents in this field to delve into research for a long time, systematically master the classic theories and cutting-edge trends of the discipline, and form a solid, extensive and integrated knowledge system. The foundation is reflected in high-quality output: publishing a series of high-level papers in authoritative journals and publishing monographs with academic weight; undertaking and completing major and key scientific research projects at the

national, provincial and ministerial levels; and finally forming original and landmark academic achievements, thereby enhancing personal academic influence. For example, a researcher in sociology at a certain research institute has published 25 papers in CSSCI journals, 3 monographs, and the papers have been cited more than 300 times; presided over 2 national social science fund projects; won 1 Outstanding Scientific Research Achievement Award of Colleges and Universities by the Ministry of Education; and 5 think tank reports have been adopted by the provincial government. The above achievements have played an important supporting role in being selected as a national high-level talent.



**Figure 1.** Talent competitiveness model in the field of philosophy and social sciences in “Double First-Class” universities

### 5.3.2. Innovating academic viewpoints

The innovation of academic viewpoints is the soul of the competitiveness of talents in philosophy and social sciences. This requires talents to bravely put forward original and breakthrough insights on major theoretical issues, classic academic propositions or emerging social phenomena. Universities should encourage “problem-oriented” exploratory research and support talents to promote the expansion of knowledge boundaries by creating new concepts, new paradigms or new theories. For example, Ji Xianlin put forward pioneering literary criticism concepts such as “literature and humanism” and “20th-century Chinese literature”, and was one of the most influential humanities scholars in China since the 1980s.

### 5.3.3. Adhering to the principle of “connecting the top and grounding the foundation”

Adhering to the principle of “connecting the top and grounding the foundation” is the key path to achieve high-quality development and build the philosophy and social sciences system. The so-called “connecting the top”

means that talents in philosophy and social sciences in universities should have a macro strategic vision and theoretical innovation ability, be able to stand at the height of national development, respond to the propositions of the times, and serve the major national strategic needs. The so-called “grounding the foundation” emphasizes that talents should be rooted in reality, serve the society, closely combine theoretical research with social practice, and make research achievements truly transformed into practical forces for promoting social progress. For example: young talents from Renmin University of China focus on the national strategy of rural revitalization and urban-rural integration, preside over more than 10 projects such as the National Natural Science Foundation of China, and won the first prize of the Land and Resources Science and Technology Award of the Ministry of Natural Resources.

#### **5.3.4. Seizing strategic positions**

Talents in philosophy and social sciences must have a keen sense of the times and forward-looking layout capabilities, and should take the initiative to “occupy positions” on key themes and nodes. This requires talents not only to keep up with academic frontiers but also to closely follow major national annual themes (such as common prosperity), respond to important historical nodes (such as the founding anniversary of the People’s Republic of China) and changes in social trends. By laying out relevant research in advance, they can take the lead in explaining major theoretical and practical issues, and deeply integrate academic activities into the process of the times, thereby significantly enhancing the timeliness, influence and strategic value of their work. For example, teachers from Yunnan University, Guangdong University of Foreign Studies and Jinan University all carried out research combined with their own fields, local characteristics and the “Belt and Road” after the release of “Vision and Actions on Jointly Building the Silk Road Economic Belt and the 21st-Century Maritime Silk Road” in 2015, and obtained major national social science projects in the same year.

#### **5.3.5. Contributing to teaching and talent cultivation**

Teaching and talent cultivation are the fundamental responsibilities and core missions of talents in philosophy and social sciences, and the ultimate embodiment of their competitiveness at the social value level. This requires talents to cultivate students’ solid professional foundation, critical thinking and family and country feelings through high-quality teaching, and cultivate a large number of outstanding reserve talents in philosophy and social sciences, which constitutes the fundamental standard for evaluating the effectiveness of talents’ teaching.

#### **5.3.6. Making sustained policy contributions**

The competitiveness of talents in philosophy and social sciences is significantly reflected in their ability to transform academic wisdom into policy practice serving the country and society. This requires talents to take the initiative to carry out targeted countermeasure research around major national strategic needs, social governance difficulties, and the improvement of laws and regulations, submit high-quality policy consultation reports and internal reference suggestions to the state, and participate in national legislative consultation, standard setting or system design. Through sustained policy contributions, they can enhance their influence in academic and political circles. An associate professor of law at a university has 3 research results adopted by the Supreme People’s Court and participated in the drafting of 2 laws and regulations. These achievements have played an important supporting role in his selection as a national high-level talent.



## **6. Suggestions on cultivation measures based on the talent competitiveness model in university philosophy and social sciences**

### **6.1. Adhering to independent thinking**

Adhering to independent thinking is the foundation and core source of competitiveness for talents in philosophy and social sciences. Universities must strive to create an academic environment that encourages innovation and stimulate talents' academic autonomy and original thinking. Establish a "representative work" evaluation system centered on ideological value, theoretical depth and social influence, and resolutely break the quantitative constraints of the "five-only" tendency. At the same time, provide long-term and stable funding support and a relaxed assessment cycle for scholars engaged in basic theory and long-cycle research. Encourage talents to base themselves on national practices, face major issues directly, and temper original viewpoints in the process of building an independent knowledge system, so as to realize the academic pursuit of "connecting the top and grounding the foundation."

### **6.2. Establishing a talent training mechanism based on talents**

Constructing a classified, field-specific and hierarchical "talent training based on talents" ecology is the key to activating existing talent capital and realizing academic intergenerational inheritance. The core is to give play to the "leading goose effect" of top scholars and leading talents, and systematically transfer academic vision through one-on-one allocation of "training mentors", "scientific research team support" and "major project actual combat." Actively promote the interdisciplinary "double mentor system" and encourage interdisciplinary joint guidance. At the same time, flexibly introduce well-known scholars and senior policy experts at home and abroad to serve as cooperative mentors to inject external wisdom. Universities should institutionally support the construction of various platforms such as academic communities and young scholars' salons, and transform informal academic exchanges into regular talent training platforms, forming a virtuous ecology of talent symbiosis and common prosperity.

### **6.3. Establishing a result-oriented collaborative incentive and cultivation mechanism**

Constructing a collaborative incentive system oriented to high-quality and diversified results aims to break the "five-only" stubborn diseases and stimulate innovation vitality. Emphasize "classified evaluation" and "collaborative incentive." First, according to different work natures such as basic research, applied countermeasures and education and teaching, set up differentiated achievement recognition standards, and include high-level monographs, authoritative consultation reports, high-quality courses, and major cultural project achievements into the effective evaluation scope. Second, establish interdisciplinary and cross-field achievement transformation and collaborative application channels, encourage talents to transform academic achievements into policy suggestions, social services or cultural products, and support achievements that generate significant social benefits. Finally, strengthen the recognition and sharing mechanism of team achievements, encourage assessment and incentive based on innovative teams, and form a pattern of mutual promotion between individual excellence and collective tackling.

### **6.4. Establishing a "one person, one policy" training plan**

In view of the significant characteristics of diversified and personalized growth paths of talents in philosophy and social sciences, implement precise and dynamic "one person, one policy" training. The plan is based on an in-depth diagnosis of talents' academic background, development stage, potential characteristics and



career planning, and tailor-made a personalized growth plan including goals, tasks and resource support. In the implementation process, conduct whole-process tracking and dynamic evaluation, and adjust strategies regularly. By allocating scientific research, teaching, exchange and practice opportunities in the “training project pool”, and matching corresponding mentor and platform support, maximize the release of talent potential and help them form unique academic advantages and core competitiveness.

This study focuses on the systematic construction of the talent competitiveness in the field of philosophy and social sciences in “Double First-Class” universities. By in-depth analyzing the deep-seated dilemmas faced by the talent development in this field in terms of disciplinary attributes, historical cycles, technological impacts and global adjustments, and grasping the historical opportunities brought by national strategic needs, era transformation nodes, technological empowerment and disciplinary paradigm integration, the study constructs a competitiveness model. Based on this model, the study puts forward cultivation suggestions. The ultimate goal of this study is to provide a framework reference with both theoretical foresight and practical operability for “Double First-Class” universities to promote the construction of talent teams in philosophy and social sciences, and help realize the organic unity of individual academic excellence, disciplinary characteristic development and the overall strategic improvement of universities.

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# A Study on the Mechanisms of Internet Memes Influencing Emotional Transmission among Adolescents

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**Abstract:** Against the backdrop of highly developed online emotional transmission, viral internet memes have become the primary vehicle for adolescents' emotional expression and empathetic resonance. This paper examines the mechanisms through which memes influence adolescent emotional transmission, constructing a tripartite "psychological-societal-technological" framework grounded in interdisciplinary perspectives. By analyzing memes' emotional encoding characteristics, transmission pathways, alienation risks, and the three-dimensional framework, it delineates the complete chain of emotion: encoding-transmission-resonance-mutation. The study reveals that viral memes achieve multifaceted emotional expression through minimalist symbols, forming dissemination pathways through the synergistic interplay of technological, social, and psychological factors. Concurrently, risks of emotional polarization and affective commodification persist. Their impact on adolescent emotional transmission is dual-edged: while simplifying expression, fostering group identification, and facilitating positive emotional regulation, they may also precipitate information silos, expressive capacity atrophy, and distorted value systems. This paper constructs an integrated analytical paradigm spanning psychological, social, and technological dimensions. Within this framework, it investigates the mechanisms through which viral internet memes influence adolescent emotional transmission.

**Keywords:** Internet memes; Adolescents; Emotional contagion; Influence mechanisms; Duality

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## 1. Introduction

Against the backdrop of the rise in online emotional contagion, viral internet memes have become a significant form of cultural expression among young people. They not only influence how adolescents interact with one another but also serve as a vital channel for expressing emotions and seeking resonance. Young people's active participation in creating and disseminating these memes imbues them with rich emotional connotations. Existing research has explored the drivers behind the popularity of viral internet memes from multiple perspectives.

Scholars generally agree that this is closely linked to adolescents' identity formation, group belonging, and emotional states <sup>[1-2]</sup>. Platform technologies accelerate meme dissemination, creating an “amplifier” effect for emotional diffusion <sup>[1-3]</sup>. Simultaneously, memes are viewed as a form of “social currency” and subcultural symbols <sup>[2-3]</sup>. It is noteworthy that the influence of such emotional contagion has shown a trend towards younger age groups, potentially exerting negative guidance on adolescents whose values are still developing <sup>[4]</sup>. Current research largely remains at the level of describing viral memes and their impact, with the mechanisms through which they influence emotional contagion among adolescents yet to be fully explored. How exactly are emotions encoded within viral memes? During participatory dissemination among adolescents, how do emotions undergo resonance, amplification, or even distortion? How do technological platforms, community interactions, and psychological contexts synergize throughout this process? These questions warrant further investigation.

This paper aims to focus on the “mechanisms of influence”, seeking to construct an integrated analytical framework. It prioritizes examining how online viral memes trigger emotional resonance among adolescents, enabling rapid dissemination and potentially leading to emotional polarization.

## **2. The multidisciplinary impact of viral memes on adolescent emotions**

A Study on the Impact of Viral Internet Memes on Adolescent Emotional Transmission is grounded in an academic framework that draws upon multiple disciplines. From a communication theory perspective, adolescents actively engage in the dissemination of memes as a means to fulfil diverse needs, including emotional catharsis and group identification, thereby constituting the intrinsic motivation for their participation in such transmission <sup>[5]</sup>. Castells' theory of the “network society” reveals that, empowered by technology, viral memes function as “fluid symbols” of the digital age. They leverage digital media technologies such as algorithmic precision targeting on short-video platforms and viral social dissemination <sup>[1]</sup>. Simultaneously, by virtue of its simplicity and ease of dissemination, it has transcended the temporal and spatial constraints of traditional communication, thereby establishing an exclusive emotional interaction space for young people.

At the psychological level, social identification theory explains the mechanism by which adolescents reinforce group belonging through the use of viral memes—these memes serve as a “token of recognition” within young people's social circles, enabling them to identify kindred spirits through a single reference and thereby solidify emotional bonds within the group <sup>[3]</sup>. The theory of emotional contagion provides a framework for understanding the emotional transmission effect of viral memes. The condensed emotional symbols within these memes rapidly disseminate through social interactions, generating collective emotional resonance at the group level <sup>[6]</sup>.

Within the field of cultural studies, the Birmingham School's subculture theory posits that viral memes function as a form of “clique code” among youth. At their core, these phenomena represent groups seeking validation and expressing attitudes through self-generated or popularized modes of expression. The emotional transmission process inherent in such phenomena implicitly involves dialogue and negotiation with mainstream culture <sup>[7]</sup>. Digital cultural studies, meanwhile, focus on platform technologies and algorithmic logic, examining how these shape the dissemination pathways and emotional evolution trajectories of viral memes.

### **3. Current research progress and limitations**

#### **3.1. Three core issues in existing research**

Existing research has crystallized into three core themes: Firstly, studies examining the correlation between viral meme dissemination and adolescents' social psychology. Empirical investigations have confirmed that the prevalence of viral memes is highly correlated with adolescents' psychological states, such as stress venting and identity anxiety. The spread of viral memes like "lying flat" and "internal competition" reflects contemporary adolescents' existential predicaments and emotional demands <sup>[2]</sup>. Secondly, research into dissemination mechanisms enabled by technology has focused on analyzing how functions such as algorithmic recommendations and social sharing accelerate the emotional diffusion of viral memes, forming the technical logic behind "viral spread" <sup>[8-9]</sup>. Thirdly, research into the societal impact of viral memes has yielded both positive assessments of their role in fostering group cohesion and enriching emotional expression, alongside concerns over potential issues such as emotional polarization and value distortion <sup>[10-11]</sup>.

#### **3.2. Limitations of existing research**

In terms of research perspective, studies tend to favor single-dimensional analysis, lacking an integrated examination of psychological mechanisms, social interactions, and technological platforms. Regarding research content, emphasis is placed on phenomenological description and impact assessment, with insufficient analysis of the complete chain of emotion "encoding-transmission-resonance-mutation." Research methodologies predominantly employ quantitative approaches centered on disseminating data statistics, while qualitative studies fail to delve deeply into adolescents' individual experiences, resulting in superficial understandings of influence mechanisms.

### **4. Trending memes and their dissemination mechanisms among young people**

#### **4.1. The emotional encoding mechanism of viral internet memes**

The emotional transmission of viral internet memes originates from their unique emotional encoding mechanism. This encoding exhibits two defining characteristics: firstly, symbolic transformation, whereby "complex feelings are distilled into concrete expressions—such as conveying emotional breakdown with 'broken defenses' or conveying utmost praise with 'YYDS'—simplifying emotional articulation"; Secondly, dual emotional attributes: a double entendre where a single meme may encapsulate two or more emotional expressions. For instance, a meme might ostensibly convey humor, anger, or joy, yet conceal underlying sentiments. "EMO" signifies not merely sadness but also the latent loneliness beneath; "giving up" appears as resignation yet truly expresses a sense of powerlessness towards life, studies, or work. This imbues seemingly simple memes with complex emotional layers.

The emoticons trending in viral memes do not emerge from thin air, but are intrinsically linked to real-world social events and shared collective experiences. This approach not only fulfils young people's need for rapid emotional expression, but also fosters a sense of group identity through emotional sharing, as these memes are understood only by those "in the know."

#### **4.2. The diverse pathways of viral internet memes**

The dissemination of viral memes is not a linear process, but rather the result of the interplay between technology, psychological identification, and social dynamics, forming a transmission pathway characterized by



“technological empowerment – group interaction – emotional amplification”<sup>[12]</sup>. At a technical level, algorithmic recommendation systems precisely deliver trending memes to target audiences based on user preferences. Meanwhile, the “like”, comment, and share functions on social platforms provide convenient channels for emotional interaction, enabling individual sentiments to rapidly coalesce into collective sentiment<sup>[13–14]</sup>.

At the level of social interaction, adolescents adapt and imitate trending memes through acts such as “secondary creation” and “mimetic dissemination” before propagating them further. This interactive process not only amplifies the original emotional resonance of the meme but may also transform it, generating distinct emotional connotations. Moreover, emotions can “set the tone”, guiding adolescents’ expressions to ultimately forge a unified emotional response, thereby propelling the emotional transmission of trending memes.

### **4.3. The risk of alienation in emotional transmission**

The emotional contagion of viral memes, while yielding positive effects, also harbors risks of alienation. On the one hand, emotional polarization is becoming increasingly pronounced. Under the dual influence of algorithmic “information silos” and adolescent group identity, extreme sentiments within viral memes tend to be amplified, exacerbating emotional antagonism between different groups. Some adolescents, seeking group acceptance, blindly follow trends by disseminating trending memes laden with negative sentiment. This spreads pessimism, anger, and similar emotions within their circles, thereby eroding young people’s capacity for rational, neutral problem-solving.

On the other hand, a pronounced trend towards emotional consumption has emerged. Certain platforms and merchants capitalize on the traffic generated by viral memes, packaging the emotional symbols within them as “selling points” to attract attention. Examples include merchandise such as plush toys and clothing inspired by the viral phrase “Chicken, you’re gorgeous.” This commercialization dilutes the original emotional resonance of viral memes, gradually eroding young people’s authentic sense of self-expression in emotional communication. Moreover, as younger adolescents possess underdeveloped judgment and lack the capacity to independently discern complex emotions within memes, they become susceptible to negative influences, fostering one-sided or even extreme perspectives.

### **4.4. Psychological-social-technical influence mechanism framework**

The impact of viral internet memes on adolescents’ emotional contagion is fundamentally the result of the interaction between three-dimensional factors: psychological, social, and technological<sup>[15]</sup>. The psychological dimension determines adolescents’ selection and receptiveness to viral memes, providing the intrinsic motivation for emotional contagion; the social dimension reinforces the direction of emotional contagion through community norms and the prevailing online atmosphere; the technological dimension influences the speed and scope of emotional contagion via platform features and algorithmic recommendations.

These three dimensions are interwoven and dynamically interact: technological platforms generate viral memes that satisfy adolescents’ psychological needs; adolescent group interactions then amplify emotional contagion through technological channels, while the effects of this contagion in turn influence platform algorithms and societal culture. This integrated framework facilitates a comprehensive understanding of the underlying logic by which viral memes shape adolescents’ emotional contagion.

## **5. Research findings**

### **5.1. Points of convergence with existing research**

Internet memes, through their heightened emotional resonance and viral transmissibility, provide adolescents with a low-cost vehicle for emotional expression and a sense of group belonging. This finding aligns closely with prevailing perspectives in the literature. At the level of emotional resonance, the mechanisms underpinning the popularity of memes such as “lying flat”, “emo”, and “breaking down” observed in this study’s case studies corroborate the theory of emotional contagion referenced in the literature <sup>[16]</sup>. These viral memes transform complex, nuanced personal emotions—such as anger, sadness, or shock—into symbolic, replicable cultural units, significantly lowering the threshold for expressing and understanding feelings. When adolescents employ these viral memes, they are not merely conveying a word but achieving an instantaneous emotional resonance. Without needing to elaborate on specific grievances, they swiftly garner “likes” or empathetic comments from peers sharing identical sentiments. This rapid, widespread emotional resonance amplifies the efficacy of emotional transmission, aligning with scholarly perspectives that “symbolized emotions accelerate social identification” <sup>[16]</sup>. At the level of identity formation, the theory of social currency cited in the literature review indicates that mastering and creatively employing trending memes within specific subcultures has become a crucial means for adolescents to establish identity within their peer groups and distinguish “self” from “other.” This precisely corroborates existing research highlighting the pivotal role of “subcultural capital accumulation” in adolescent identity construction <sup>[17]</sup>.

### **5.2. Differences from existing research and analysis of reasons**

This paper also diverges from certain perspectives in the literature: the impact of viral internet memes on adolescents’ emotions is not merely a matter of “negative catharsis”, but also encompasses a positive function of emotional regulation and meaning construction <sup>[18]</sup>. Much early scholarship posited that viral memes fostered moral relativism and diminished communicative capacity. Yet this case study reveals that the deployment of internet memes frequently constitutes a dual-faceted form of emotional regulation. For instance, the popularity of the viral meme “mental energy drain” has not only provided young people with a term to describe their anxious state but also sparked widespread discussions and sharing of experiences on “how to reduce internal friction.” By externalizing and downplaying negative emotions through humor, young people gain a sense of control and psychological distance from their feelings, itself a positive coping strategy for managing distress. This wisdom of finding humor in hardship is overlooked by the “pessimism theory” perspective.

The reasons for this discrepancy may lie in two factors: firstly, the temporal relevance of the research subjects. Recent viral memes increasingly focus on expressing complex social sentiments, with their evolution reflecting shifts in young people’s motivations and societal moods, moving beyond the simpler emotional venting observed previously. Secondly, the depth of the research methodology. This paper captures the positive aspects of viral memes by deeply analyzing their contextual usage and interactions within social settings, whereas macro-level trend studies predominantly observe only the superficial phenomenon of emotional venting.

### **5.3. The Construction of emotional identity and group belonging among adolescents**

Trending memes, being prolonged recipients of emotional value, are easily swayed by the deliberately conveyed emotional value of others, leading to distorted interpretations of emotional value among adolescents. Young

people seek emotional resonance and social recognition by employing shared “cultural code” memes such as “EMO” and “YYDS”<sup>[1]</sup>. Thereby fostering a sense of group belonging.

Trending memes possess “emotional value”, offering stress relief and an outlet for emotional expression. However, it is important to note that overreliance on such memes may weaken one’s ability to articulate thoughts. Some adolescents may become immersed in the instant gratification provided by memes, retreating into an “emotional comfort zone” that diminishes their capacity for deep reflection and expression, leading to a phenomenon known as “textual aphasia”<sup>[2]</sup>.

#### **5.4. Platform algorithms and reinforcement mechanisms in emotional transmission**

The authors have observed that platforms employ technological means such as intelligent recommendations and interactive features to enhance the dissemination efficiency of viral memes. Algorithms guide user engagement through actions like likes and comments, precisely delivering trending memes to create “information silos” and “emotional echo chambers.” Research indicates that the relationship between emotional intensity and user engagement is non-linear; that is, stronger emotions do not necessarily yield more pronounced interaction effects. In contrast, simple emotions like joy or sadness are more likely to trigger deeper emotional resonance (such as empathy or moving experiences) among users, thereby fostering interaction. Moreover, the impact of negative emotions on engagement is complex. While anger may boost interaction, it risks fueling emotional polarization and negative information diffusion. Conversely, emotions like sadness or fear may diminish the user’s willingness to engage. Consequently, data indicates that highly arousing content—such as that evoking anger or empathy—is more likely to garner likes and shares, thereby receiving algorithmic amplification<sup>[19]</sup>.

The closed-loop mechanism of “emotion-interaction-recommendation” continuously amplifies emotional responses, while rational and complex expressions of sentiment are consequently marginalized<sup>[19]</sup>.

### **6. The double-edged sword nature of emotional contagion**

#### **6.1. The positive impact of viral internet memes on emotional transmission among adolescents**

Trending memes, as “symbolic carriers” for emotional transmission, lower the threshold for expression. By engaging with such memes in group interactions, adolescents gain both emotional resonance and a sense of collective belonging, aligning with the logic of social identity theory<sup>[13]</sup>. The intelligent recommendation system, functioning as a “diffusion engine”, precisely delivers tailored content to reduce acquisition costs and primarily facilitates rapid emotional resonance. The open nature of the online environment grants young people equal rights to express themselves, thereby amplifying the proactive nature of emotional transmission<sup>[20]</sup>.

#### **6.2. The negative impact of viral internet memes on emotional transmission among adolescents**

The “information silos” fostered by intelligent recommendation algorithms homogenize young people’s language, solidify cognitive boundaries, and readily provoke emotional polarization. The irrational nature of viral memes and linguistic distortion erodes adolescents’ expressive and communicative abilities, intensifying their entertainment-driven tendencies. This traps them in fleeting pleasures, diminishing their capacity for critical thought<sup>[21]</sup>. The emotional resonance generated by viral memes can lead adolescents to become overly reliant on the internet, trapping them in a vicious cycle of “real-world needs being neglected — reliance on

the emotional resonance of viral memes — deterioration of academic and social skills”, thereby distorting the normal logic of emotional transmission.

## 7. Conclusion

This paper employs a psychosocial-technological triadic framework to dissect the mechanisms through which viral internet memes influence emotional contagion among adolescents, tracing the complete chain of emotion encoding, transmission, resonance, and mutation. Findings reveal that memes achieve emotional encoding via symbolic transformation and dual emotional attributes, forming highly efficient transmission pathways through the synergy of algorithmic amplification and group interaction. They thus emerge as core vehicles for adolescents’ emotional expression and group identity formation. The emotional transmission of viral memes exhibits marked duality: on one hand, serving as vehicles for emotional expression and social currency, they aid adolescents in gaining emotional support, regulating moods, and fostering group belonging; on the other, algorithmic recommendations create “information silos”, the proliferation of stale memes, and erosion of psychological well-being can readily lead to cognitive narrowing, diminished expressive capacity, and distorted values among young people. The impact of viral internet memes on adolescents’ emotional transmission stems from the complex interplay of psychological, social, and technological factors.

## Disclosure statement

The authors declare no conflict of interest.

## Author contributions

Xiang Lin and Jiahao Zheng conceived the idea of the study. Hao Geng and Yuyi Zhu performed the experiments. Xintong Liao and Jiali Su analyzed the data and wrote the paper.

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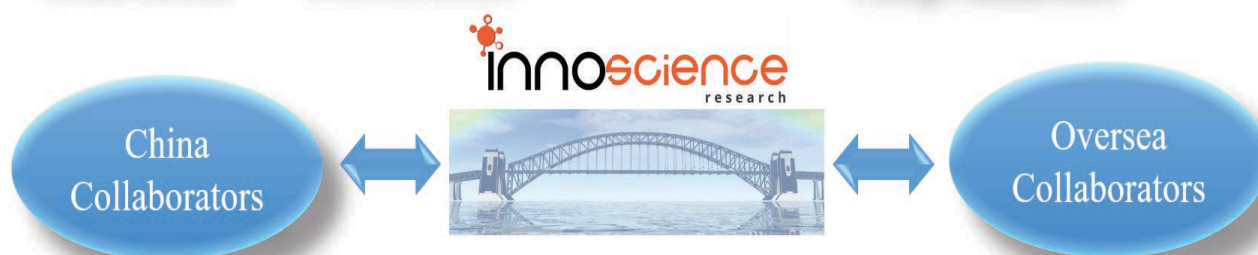
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