



# Grounded theory-based analysis of occupational health and safety management modes in supply chain by core enterprises ——evidence from China

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## ABSTRACT

The implementation of occupational health and safety management in the supply chain by core enterprises is a significant step towards improving the working conditions of their suppliers. To guide core enterprises to adopt active and effective management modes, it is crucial to identify the characteristics of different management modes and classify them accordingly. This paper employs the grounded theory method to conduct an in-depth analysis of occupational health and safety management modes within the supply chain of core enterprises. This research mainly adopts semi-structured interview method. A total of 16 person-times are interviewed, and 210,000 words of in-depth interview scripts are obtained. After three coding process of the grounded theory, the evolution model of occupational health and safety management modes in supply chain by core enterprises was established. The research results indicate that core enterprises currently employ three modes of occupational health and safety management for their suppliers: defensive mode, passive mode, and strategic mode. Different modes have distinct characteristics in four dimensions of cognition, motivation, strategy and result. This research may provide strategic guidelines for core enterprises to evolve from the defensive mode to the strategic mode.

## 1. Introduction

Occupational Health and Safety (OHS) issues are a pressing concern for governments, workers, and employers worldwide, especially in small and medium-sized enterprises (SMEs) [1]. SMEs have been recognized as a crucial driver of economic growth and job creation in many countries [2,3]. OHS is particularly important for SMEs. Employees in SMEs are often exposed to hazardous situations and are more likely to suffer from work-related injuries and illnesses compared to those working in larger companies [4]. Small businesses often lack the resources or expertise to effectively manage risks. This can result in a lower level of safety compared to larger businesses [5,6]. Moreover, small businesses prioritize economic issues over health and safety concerns [7].

Successful safety interventions tend to be tailored, action-oriented, and low-cost approaches that combine health and safety with

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other management goals. These interventions are based on trust, participation, and dialogue [8–10]. SMEs often struggle to obtain advice and support from external sources, leading them to rely on established relationships for guidance [11]. Managing OHS in SMEs involves various key stakeholders, such as customers, enforcement agencies, health and safety professionals, and suppliers, who all play a role in shaping how it's done. OHS interventions need to address the characteristics of the SMEs and of stakeholders. Urbaniak (2023) identified various factors that impact small suppliers' adherence to OHS regulations. These include cost-cutting pressure from larger corporations and the requirement from such corporations for a safe work system [12]. Core enterprises in supply chain (SC) can be a better intermediary to implement OHS intervention programs for SMSs.

In all types of businesses, whether public or private, larger enterprises tend to have higher quality health and safety management systems and workplace assessments as compared to smaller ones [13]. An area of great significance for both research and practical purposes is to investigate how resources like safety inspectors, occupational health services, and business networks can help SMEs and their managers [14]. Research suggests that it can be advantageous for SMEs to engage in networks with other companies to address workplace health and safety concerns. By participating, SMEs can receive assistance and guidance, as well as gain a broader perspective on OHS matters to promote a safe and healthy work environment [15]. As a result, small and medium-sized suppliers (SMSs) have the opportunity to join the supply chain network and access safety management services and resources provided by the core enterprises. Improving the safety of SMSs can give the entire supply chain a competitive edge and benefit the core enterprises.

In the existing studies, on the one hand, some scholars point out that core enterprises' OHS requirements to suppliers increase their burden, further compress their profit space, and have a negative effect on their OHS [16–18]. On the other hand, some scholars advocate the management of OHS in SC by core enterprises and believe that it has a positive impact on the OHS level of SMSs. As significant players in the SC, core enterprises have the ability to enhance SC management through their market influence. Nonetheless, without external regulatory pressures, the sole driving force for core enterprises to prioritize health and safety management within their SCs is market-based business incentives [19]. After a preliminary investigation, in reality, different enterprises have different cognitions, behaviors and management results of OHS management in SC. Scientific qualitative research methods should therefore be applied to answer the following questions: How many OHS management modes of core enterprises in SC are there? How do different management modes come into being? What kind of management mode can the core enterprises adopt to achieve a win-win situation in SC? And how to motivate core enterprises to take effective management behaviors?

Therefore, it is urgent to clarify the OHS management modes of core enterprises and the characteristic factors of specific mode, and explore the effective OHS management mode to promote the OHS level of suppliers under the premise of common development of SC. Based on the theoretical framework of "cognition-motivation-action/strategy-result" and grounded theory method, this paper analyzes the different modes of management of OHS by core enterprises in SC and the elements of different modes, studies which management mode can lead to positive results, and then analyzes how to motivate the core enterprise to take effective measures. The purpose of this study is to encourage more leading companies to take an active role in OHS management for SMSs. This will help achieve sustainable development for both upstream and downstream enterprises in the SC, while also contributing to ongoing research on OHS management and sustainable development within the SC.

## 2. Literature review

### 2.1. Management of social responsibilities of the SC

There is abundant literature on the management of social responsibilities of the SC. Social responsibility research has thus expanded from enterprises to the SC level. The research includes the concept, driving force, practice, and the effects of management of social responsibilities of the SC on other enterprises. Regarding the concept of social responsibilities of the SC, Poist (1989) mentioned in his research on the design of logistics systems that social responsibilities yield defensive economy benefits in the SC, and he therefore proposed the concept of Logistics Social Responsibility [20]. He was reportedly the first scholar to conceptualize social responsibilities of the SC. By then, the exact concept or definition had not been given.

Chen (2015) stated that the social responsibilities of the SC have three characteristics of core enterprise dominance, inter-chain externality, and asymmetry between responsibilities and earnings [21]. In addition to ensuring its own economic benefits and capabilities, good management of social responsibilities encompasses mandatory and ethical social responsibility behaviors. Furthermore, good management implements good behavior strategies, provides high-quality and expedited service for end-users, considers other social and environmental aspects, establishes long-term cooperative relationships with upstream and downstream enterprise suppliers, and maintains stability and sustainability of the benefits of the entire SC [22]. Good activities of social responsibilities are conducive to the coordinated governance of the SC. Social responsibilities yield economic benefits for the SC. The driving forces for these responsibilities include altruistic motivations [23], strategic motivations [24], political motivations, management's self-serving motivations [25], economic motivations [26,27] and greater social impact [28].

Management of the social responsibilities originates from the "corporate code of conduct movement" emanating from the western countries. Van (2015) proposed that how the core enterprises manage the social responsibilities of the entire SC is also a widespread concern in the corporate and academic circles [29]. Core enterprises gradually change passive supervision into active supervision. The supervision cost is the internal consumption cost of the SC system; the payment of this cost is transferred to the enterprises in the chain and invested to help with the implementation of the social responsibilities of suppliers. The passive external supervision is transformed into active collaboration within the SC, which is more conducive to improving the social responsibility level and the benefits of the SC [30]. The issue of social responsibilities is a complex systematic problem; it requires core enterprises to seek the SC-oriented systematic solution. Businesses should implement techniques and approaches that guide, oversee, and motivate their employees to proactively

meet their social obligations. Stakeholders from governments, non-governmental organizations and other parties should also collaborate and participate in creating a good and organized social responsibility environment through a series of policies and measures; this promotes the implementation of the social responsibilities and achieves sustainable development of the SC. The earliest practice of social responsibilities of the SC in China began in the 1990s. To a certain extent, it is also the international transmission effect of the corporate codes of conduct movement", which emanated from western countries [22]. With a constant appeal from a few non-governmental organizations and the public, developed countries in Europe and America have begun to institute trade barriers such as labor and environmental standards to restrict access to imported goods. As a result, the exporting enterprises in developing countries are triggered to improve their performance in social responsibilities. Several studies have also indicated that such enterprises in developing countries promptly perform better in social responsibilities. Meanwhile, the greater the intensity of trade, the better the performance of corporate social responsibility [31,32].

Managing social responsibilities should start from the core enterprises in the SC. In addition to managing their own social responsibilities, they should manage the social responsibilities of the partners in their own country and the host country, and shoulder the responsibilities of guiding, managing and supervising the upstream and downstream suppliers [33]. The research by Ciliberti & Pontrandolfo (2008) found that SMEs lack the motivation to establish long-term corporate social responsibilities; they are more inclined to use their resources to solve the key issues of survival and development. Generally, these enterprises have a relatively higher probability of negative externalities for reducing costs [34]. Bhattacharya & Tang (2013) believed that customers tend to pass cost pressures and risks to the SC; also, the influence of customers may be actively used to strengthen the supplier's working environment [35]. Core enterprises have the absolute right to influence the upstream and downstream enterprises; thus, social responsibilities of the SC are centered on them [36,37]. For example, Nike, a renowned brand, began to relinquish low-cost procurement to enterprises at the end of the SC to help them improve their labor, environment and other conditions. This capacitates their suppliers to change the existing production modes and customize their social responsibilities [38].

## 2.2. OHS management behaviors of the core enterprise in SC

OHS is an important part of corporate social responsibilities. Therefore, Occupational Health and Safety Management (OHSM) is included in the management of the social responsibilities of the SC. Research done on the management of the social responsibilities provides a solid theoretical basis to manage OHS in the SC. Management of OHS attracts increasing attention from the academic circle and governmental agencies. Some researchers have studied the importance of OHSM in the SC of core enterprises, its implementation measures and the influential factors of the implementation. Good health and safety standards in the SC are critical to the quality of the products, corporate value, capabilities, and reputation of the enterprises; standards maintain the interests of all enterprises in the SC [39]. Although the importance of OHS in the SC has been recognized by the industry, there is lack of research on governance mechanisms, including guidance, specific evaluation, and training of suppliers [40–42]. In a business environment, retailers can take some measures to implement OHS in their SC. As a result, Harpur recommended that the government should consider legal action against retailers that have not taken any measures to implement OHS in their SC [43]. To solve the OHS issues in the SC, core enterprises should have their own safety standards, and then restrain and guide the enterprises, thus forming good social effects and improving the safety of the SC [44,45]. Nadvi & Raj-Reichert (2015) stated that companies with global brands are still under significant pressure to make sure that their suppliers are following labor standards and codes of conduct [46]. However, these standards seldom apply to lower-level suppliers, and there is little research on how these suppliers, such as secondary suppliers, implement labor standards [47,48]. An extension of the SC leads to the weaker intensity of OHSM [49–51]. According to Walters et al. (2016), the SC can improve OHSM more effectively when it operates within a broader institutional framework that includes public and governmental supervisions as key factors [52].

Therefore, OHSM of core enterprises in the SC calls for the adoption of some SC management measures, including training, reward and punishment measures, and procurement strategies. This improves the levels of OHSM of upstream as well as downstream enterprises. Core enterprises have different modes of management of OHS influenced by various factors. Although the existing research on OHSM in the SC largely influences our paper, systematic theoretical research on this aspect is still lacking, especially the research focusing on the modes and characteristics of OHSM in the SC by core enterprises in China. Based on the research review, the paper extensively collects case data about OHSM of core enterprises in the SC and explores the different modes of management of OHS by core enterprises in the SC using the grounded theory method.

## 2.3. Review

An integration of corporate social responsibilities and SC management and sustainability explains the inevitable trend of social responsibilities of the SC. Industries have unique SCs and corresponding social responsibilities; thus, industry-led research is paramount [53]. Existing research has not systematically analyzed the characteristics of the core enterprises' management modes of OHS in the SC of different industries. This paper focuses on the core enterprises' management of OHS of SMEs in the SC in the manufacturing industry. In the context of today's new economic mode, China's SMEs in manufacturing are an important part of economic transformation and development. The OHS standards of these companies, which are crucial manufacturing links within the SC, have a significant impact on the growth of other companies in the same SC. How can the OHS levels of SMEs be ensured and high-quality development of the SC and economy be promoted? How can the correctness and effectiveness of policy support be improved? It is important for core enterprises to make OHS management a priority in their SC and promote it accordingly. In this field, China has significant theoretical progress to make compared to other countries. While some international studies have examined the OHS

management of core enterprises in the SC, they often fail to address the challenges faced by developing countries. Moreover, they have not adequately explained the categories and characteristics of the management modes of OHS of core enterprises.

Based on the above scenario and the characteristics of the manufacturing industry, the paper intends to establish the characteristics and evolution model of the core enterprises' management modes of OHS using the grounded theory method from abundant data. A theoretical basis for core enterprises' management of OHS and a decision-making basis for the promotion strategies are provided in this paper.

### 3. Research methods and data

#### 3.1. Research methods

The grounded theory method is a systematic approach to collecting and analyzing data in order to explore and conceptualize theories. Glaser and Strauss presented the use of grounded theory for analyzing qualitative data in their 1968 book, *The Discovery of Grounded Theory: Strategies for Qualitative Research* [54]. In 1990 and 1998, Strass and Corbin respectively made significant enhancements to the grounded theory method [55]. This method is mainly utilized for discovering new theories. Researchers of this theory collect qualitative data from a variety of sources, analyze them using coding and theoretical sampling procedures, and then help build the data-based theory using a set of interpretation procedures.

The research is relatively new. Currently, some enterprises, such as Huawei and Nike, have good practices. Other core enterprises have not conducted OHSM in the SC. The characteristics of the core enterprises' management modes of OHS for SMEs in this study cannot be explained by the existing theories. The grounded theory method, on the other hand, can explain and classify different management modes and their characteristics by analyzing relevant case data. Thus, the paper summarizes the concepts and categories that reflect the characteristics of different management modes; this paper presents conclusions that were drawn using grounded theory, which is widely regarded as a rigorous qualitative research method [56,57].

Based on data collection, the research organizes and encodes data in batches using the Nvivo software in accordance with the grounded theory research paradigm. This paper provides an overview of the distinctive characteristics of different management approaches adopted by core enterprises, using open coding, axial coding, and selective coding. It concludes by presenting and elaborating on a theoretical model that describes the evolving features of these modes and how they relate to the management of OHS in SMEs.

#### 3.2. Data sources

This research mainly adopts semi-structured interview method. The interviewees include purchasing managers, SC sustainable development managers, general managers of supply enterprises, and OHS department managers. A total of 16 person-times are interviewed, and 210,000 words of in-depth interview scripts are obtained. See [Table 1](#). In addition, in order to ensure the accuracy and validity of the data, data were collected from multiple perspectives in this study, as shown in [Table 2](#). On the one hand, data from multiple sources can make theoretical extraction more comprehensive; on the other hand, cross-analysis and mutual verification can

**Table 1**  
The interviewees.

Enterprise	Scope of business	Recording time	Investigation content	Purpose
1	Design and manufacturing of aerogenerator	90mins	Interviewing with sustainable development director twice	for coding
2	R & D and manufacturing of automobile	50mins	Interviewing with SC technical manager once	for coding
3	R & D and production of auto parts	40mins	Interviewing with OHS manager once	for coding
4	R & D and production of medical products	90mins	Interviewing with OHS manager once	for coding
5	R & D and manufacturing of passenger cars	90mins	Interviewing with the head of supplier development manager once	for coding
6	R & D and manufacturing of chip	45mins	Interviewing with production manager once	for coding
7	R & D, production and sales of automobile	40mins	Interviewing with manager of SC management department once	for coding
8	R & D and production of auto parts	60mins	Interviewing with OHS manager once	for coding
9	R & D and manufacturing of drug	100mins	Interviewing with OHS department manager once and purchasing department manager once	for coding
10	Production of decorative building materials	60mins	Interviewing with purchasing manager once	for testing
11	Development and production of diesel engine	120mins	Interviewing with purchasing manager once and production manager once	for testing
12	R & D and production of automotive sensors	150mins	Interviewing with general manager once and purchasing manager once	for testing

be carried out to increase the credibility of the conclusion. In order to ensure the rationality of causal inference, internal and external data and interview data were mutually verified to ensure their consistency and accuracy. The textual data were conceptualized and categorized in accordance with category induction and model building steps strictly following the grounded theory method. At the same time, the controversial concepts and categories should be deleted and revised with reference to experts' opinions, so as to avoid the subjective influence of the coders on the data coding results to ensure the research reliability and validity.

#### 4. Data coding analysis

The coding process of the grounded theory has three stages: open coding, axial coding, and selective coding. In open coding, researchers describe data by checking it per row. This strategy—focusing on small data units and their interpretations—encourages theoretical sensitivity from new data ideas and prevents data from existing categories. After completed categories have been determined, axial coding is performed, and the data are regrouped in new ways by establishing links among various categories and major categories are therefore concluded. Subsequently, the selective coding step is implemented to systematically identify the relationships among main categories and establish an original theoretical model. After the conceptual model is obtained, the theoretical saturation test is performed, and the final theoretical model is confirmed.

##### 4.1. Open coding

The obtained data was imported into Nvivo12 software for encoding. By encoding the original statements, we could eventually derive the concepts related to the OHSM modes of the core enterprises and then obtain the categories. In total, 31 categories and 94 concepts were obtained via open coding, as shown in Table 3. For example, the category of safety audit is abstracted from these concepts of all kinds of audit modes, bearing part of the cost of factory inspection, supervising inspection company, correcting audit deviation and training auditor. Among them, the corresponding original statements and labels of the concept of all kinds of audit mode are as follows: "A third-party verification agency EICC is entrusted to conduct regular inspection of suppliers"(regular inspection), "On-site investigation of more than 200 other Chinese suppliers"(on-site review), "Inviting customers to visit the site, jointly conducting an audit for suppliers, the survey of employees, joint seminars and supplier capacity improvement projects"(joint audit), "introducing third party organizations to audit suppliers"(third-party audit), "Due diligence enables the enterprises to change from being passive for more than a decade to being active now"(Due diligence).

##### 4.2. Axial coding

Axial coding is a process that involves organizing and summarizing initial categories into major categories by examining the connections between different categories. Following the axial coding method, we have identified 12 major categories. Table 4 displays how the initial categories relate to these major categories and the implications that come with them.

##### 4.3. Selective coding

Selective coding involves categorizing and abstracting major groups to determine the core categories. This is done by examining the relationships between them. The typical relational structures among the 12 major categories and the core categories composed of them are shown in Table 5.

Fig. 1 is a conceptual model diagram formed by selective coding. Fig. 1 shows three types of management modes are composed of different combinations of "cognition-motivation-strategy-result". The evolution from one mode to another requires changing of the corresponding characteristics combination. That is to say, the evolution of SC OHSM model needs the synchronous evolution of cognition, motivation, strategy and result, but the key first step is the evolution of cognition.

##### 4.4. Theoretical saturation test

One of the main verification methods of the grounded theory is the theoretical saturation test [55]. In such a test method, researchers continue to collect data until categories are depleted.

To verify that the theoretical model we created earlier has achieved theoretical saturation, we conducted a theoretical saturation test on the remaining four interview transcripts using Nvivo12 software. The test is repeated following the research steps of grounded

**Table 2**  
Data source classification.

Data Source	Data classification
Firsthand material	Data obtained through in-depth interviews
	Data obtained through informal interviews
	Data obtained through field observation
Second-hand material	Archives, brochures, PPT and other materials obtained through the enterprise
	Relevant network information through web crawler

**Table 3**  
Open coding.

Categories	Data classification
Cognitive deficit	Not formed cognition, primary cognition, not extended to the SC, not integrated into the development strategy
Management difficulties	Large scale suppliers, fierce competition, insufficient resources
Seeking profit	Refusing to invest, pursuing short-term effect
Bullying the weak	Responsibility transfer, cost transfer
Low price purchasing	Low cost strategy, deferred payment, suppliers reduce costs
Prompt delivery	Short delivery time, ignoring supplier overtime, controlling inventory cost
Uneven distribution	benefit more, bear less responsibility
Strong position	high status, strong bargaining power
Public concern	Public awareness, public demand, paying attention to the SC of brand
Media disclosure	Omnipresent media, public opinion environment
Institutional supervision	International community requirements, the requirements of some countries
Consumer demand	Market demands, consumer concerns, customer expectations
Corporate image	Brand image, corporate reputation
Written honor	Performance report, commendation, supplier code of conduct, CSR report
Backward measures	Simple working methods, excessive factory inspection, strict punishment measures, no incentive scheme
Poor execution	tolerating fraud, providing no help, no information disclosure, no function decomposition
Supplier perfunctoriness	Accepting audit perfunctorily, insufficient ability of suppliers
Supplier fraud	concealment of the actual situation, untrue factory inspection reports, collusion with factory inspection organizations
Advanced cognition	Improving the status, changing the concept, ensuring the implementation, balancing the conflict of justice and interest, community of interests
Leadership will	Leadership awareness, leadership attention, leadership support
Development strategy	Coordinating the business relationship, adjusting the purchasing strategy, determining the scope of supervision, formulating the cooperation agreement
Cooperative innovation	Innovative business model, interactive learning
Safety audit	All kinds of audit modes, bearing part of the cost of factory inspection, supervising inspection company, correcting audit deviation, training auditors
Assessment system	Performance evaluation, risk rating, reward and punishment system
Stakeholder participation	SC upstream and downstream participation, cooperation with NGOs, media response, cooperation with academia, cooperation with enterprises inside and outside the industry
Interactive feedback	Media exchange meeting, suppliers conference, internal communication, worker reporting platform, communication with stakeholders
Training and guidance	Seminars, training courses, case training, resource support
Cost reduction and Efficiency enhancement	Save self-audit cost, win-win SC upstream and downstream, economic benefits
Risk reduction	Reduce the risk of shutdown, reduce reputation loss, reduce accidents
Safety and health	Supplier working environment, occupational health and safety of supplier workers, community safety, social benefits

theory. Once enough data and information have been extracted from the samples to reach saturation and obtain sufficient theoretical values, the test is considered complete. Based on the results, it appears that the main categories, initial categories, and relationships have been accurately and thoroughly represented. After the test, there are no new categories and relationships except the defensive mode, passive mode, and strategic mode, and there are no new initial categories within the three main categories. The theoretical model has therefore reached saturation in theory.

## 5. Model explanations

### 5.1. Defensive mode

The core enterprises that use a defensive OHS management mode in SC may lack awareness of management. As long as the internal OHS of the enterprises is well managed, core enterprises believe that management scope is not needed to be extended to its SC, and the OHS management for suppliers is not needed to be integrated into the development strategies either. Furthermore, the scale of suppliers of core enterprises is huge and thus they lack the appropriate ability and motivation to manage OHS for a large number of suppliers. At this time, the core enterprise will be enterprise oriented to maximize their own interests at the expense of the interests of other enterprises. Core enterprises will transfer the social responsibilities of high risks such as overtime and low-cost to the weak SMSs in their SC for their own interests. When dealing with suppliers, the core enterprises take utilitarian procurement strategies that minimize the purchase prices and require timely delivery. As a result, the suppliers have no profit margin and time to improve OHS. In addition, their suppliers are usually in fierce market competition. To obtain orders from core enterprises, they have to further reduce the cost. The suppliers in the upstream of SC often bear more OHS risks than the core enterprises in the downstream of the SC, but the status and economic benefits of the former are lower than those of the later. Therefore, the defensive mode leads to an asymmetry between the core enterprises and SMSs with regard to corporate position, assumption of OHS responsibilities and distribution of benefits in SC.

**Table 4**  
Relationships between initial categories and major categories and their connotations.

Major Categories	Categories	Connotations
Cognition _ Powerful alone	Cognitive deficit, Management difficulties	The core enterprise lacks the cognition of SC OHSM and thinks that management of suppliers' OHS is full of difficulty will affect the cognition of being powerful alone.
Motivation _ Enterprise orientation	Seeking profit, Bullying the weak	The motivations of the core enterprise seeking profits and bullying the weak enterprises will affect the motivation of enterprise orientation.
Strategy _ Utilitarian purchasing	Low price purchasing, Prompt delivery	The strategies of low-cost purchasing and immediate delivery of the core enterprise will affect the utilitarian purchasing strategy
Result _ Asymmetry of power and responsibility	Uneven distribution, Strong position	The result of asymmetry of power and responsibility is caused by the uneven distribution and that the core enterprise has a higher position in SC than the supplier.
Cognition _ Passive responsibility	Public concern, Media disclosure, Institutional supervision, Consumer demand	The requirements of the public, media, government and consumers on the OHSM of the core enterprise will affect the cognition of passive responsibility.
Motivation _ Public relations orientation	Corporate image, Written honor	Core enterprises pay attention to corporate image and written honor, which affects their motivation to maintain public relations.
Strategy _ Ritual management	Backward measures, Poor execution	The backward SC OHSM measures and poor execution of core enterprises will affect their ritual management strategy.
Result _ Moral hazard	Supplier perfunctoriness, Supplier fraud	Supplier's perfunctoriness and supplier's fraud will affect the result of moral hazard in SC.
Cognition _ Justice and benefit	Advanced cognition, Leadership will	The advanced cognition of core enterprises on OHSM in SC and the positive will of senior managers will affect their cognition of both justice and profit.
Motivation _ Strategy orientation	Development strategy, Cooperative innovation	The core enterprise integrates SC OHSM into development strategy and innovates cooperation management mode will affect the motivation of strategy orientation.
Strategy _ Systematic management	Safety audit, Assessment system, Stakeholder participation, Interactive feedback, Training and guidance	The behaviors of core enterprises to carry out SC OHS audit, formulate assessment system, cooperate with stakeholders, interact with suppliers, and provide OHS training and guidance will influence the strategy of systematic management.
Result _ Sustainable SC	Cost reduction and efficiency enhancement, Risk reduction, Safety and health	Reduction of suppliers' OHS cost, the improvement of efficiency, the reduction of SC risk and the safety and healthy development of SC constitute the result of sustainable SC.

**Table 5**  
The typical relational structures and the core categories.

Typical relationship structure	Core Categories	Connotations
Cognition → Motivation → Strategy → Result		
Powerful alone→ Enterprise orientation→ Utilitarian purchasing→ Asymmetry of power and responsibility	} Defensive mode	The cognition of the core enterprise to be powerful alone will influence the motivation of enterprise orientation and the strategy of utilitarian purchasing in turn and finally result in asymmetry of power and responsibility. The transmission chain from cognition to result constitutes the defensive mode of OHSM in SC of core enterprises.
Passive responsibility→ Public relations orientation→ Ritual management→ Moral hazard	} Passive mode	The cognition of passive responsibility will influence the motivation of public relations orientation and the strategy of ritual management in turn and finally result in moral hazard. The transmission chain from cognition to result constitutes the passive mode of OHSM in SC of core enterprises.
Justice and benefit→ Strategy orientation→ Systematic management→ Sustainable SC	} Strategic mode	The cognition of the core enterprise to gain both justice and benefit will affect the motivation of strategy orientation and the strategy of systematic management in turn and finally result in sustainable SC. The transmission chain from cognition to result constitutes the strategic mode of OHSM in SC of core enterprises.

5.2. *Passive mode*

As the core enterprises are increasingly pressurized by media, customers, consumers, governments, and third-party certification agencies. Therefore, to minimize their reputational risks, prevent the responsibility risks of the SC, and increase the value of their brands, the core enterprises will take some ritual OHSM measures with the motivation of public relations orientation. For example, the core enterprises often propose a stricter code of conduct than laws and regulations for suppliers to cope with external pressure. But they only focus on several aspects such as auditing or increasing penalties and do not provide corresponding solutions after putting forward improvement requirements for suppliers. Furthermore, there are no corresponding incentive schemes to motivate suppliers to meet the requirements. Sometimes, the core enterprises neglect the falsification behaviors of SMSs and third-party organizations during the audit and the disclosure of the information is insufficient. The processing cost of the suppliers is known to the core enterprises owing to frequent inspection. As a result, the suppliers lose bargaining power. To meet the requirements for core enterprises, high-cost investment is needed; however, the profits of suppliers are not substantial. In addition, some suppliers have a fluke and risk-taking



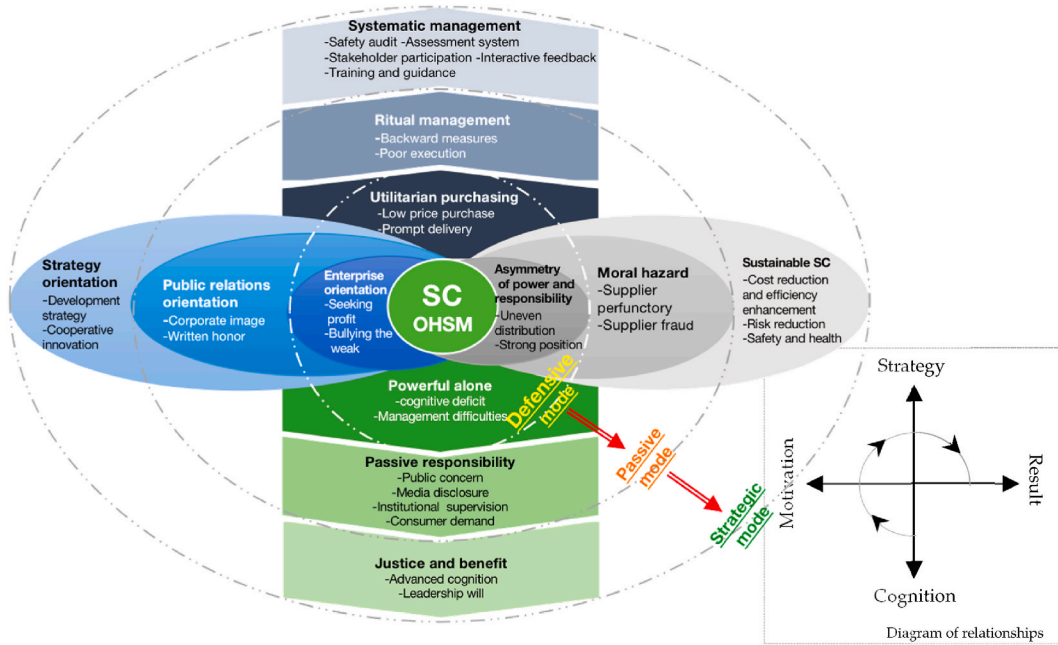


Fig. 1. Conceptual model diagram of three OHSM modes in SC.

mentality; they employ trickery by not investing in OHS, thus eventually producing associated risks. Therefore, the passive mode may result in moral hazard behaviors of suppliers.

### 5.3. Strategic mode

The characteristic of a strategic management mode is to first renew cognition. With the commitment and support of the management, a positive attitude is taken, and both economic interests and management responsibilities are considered. Different from that core enterprises passively manage OHS of the SC under external pressure, with the improvement of responsibility awareness of core enterprises, they are motivated by strategy orientation. On the one hand, they integrate SC OHS management into their development strategy, including coordinating the business relationship, adjusting the purchasing strategy, determining the scope of supervision and formulating the cooperation agreement. On the other hand, OHS management is regarded as an innovative business model and an innovative way to learning mutually with enterprises inside and outside the SC. OHS management in SC serves as an innovative mode for promoting business partnerships; a specific management system is therefore established. The first is an OHS audit of the suppliers, which is a generally accepted effective management measure. Core enterprises can adopt various audit methods according to their needs, and bear certain factory inspection costs, such as paying third-party audit service fees. In addition, they can supervise the third-party inspection organization, correct audit deviation, and train auditors.

Then, based on the audit results, the next step is to conduct a comprehensive assessment of the suppliers, including performance evaluation, risk rating and reward and punishment system. For example, business awards are given to the suppliers whose OHS conditions meet the requirements; business restrictions are imposed on the suppliers that failed to meet their requirements, and follow-up guidance is performed to help suppliers continue to improve. The suppliers that have repeatedly made no correction will be rejected to be included in the supplier list. The implementation of OHS management in SC also needs support and cooperation from stakeholders and the core enterprises will focus on encouraging participation of stakeholders, including SC upstream and downstream participation, cooperation with NGOs, media response, cooperation with academia and cooperation with enterprises inside and outside the industry. In addition, in the process of OHS management, the enterprises will focus on interactive feedback with stakeholders to ensure the smooth flow of information and improve the management transparency. The main measures include media meeting, suppliers conference, internal communication, worker reporting platform, communication with stakeholders. Last but not least, training and guidance for SC OHS managers and suppliers is essential, for example conducting seminars, training courses, case training and providing resource support. Under the strategic management mode by core enterprises, SMSs may save internal audit costs, improve working efficiency, reduce the risks of non-compliance, and have safe and healthy working environment.

## 6. Discussion and conclusions

The paper rationally explained the types of core enterprises' OHS management modes in SC and their characteristics by establishing a grounded theoretical model. The core enterprises in SC were selected as the research objects. First, interviewing middle and senior



managers of OHS management and SC management in core enterprises through visiting enterprises to obtain first-hand data. Then, the data was imported into the Nvivo12 software for coding. The grounded theory method was used to characterize the core enterprises' OHS management mode in SC, and assign various characteristics to the corresponding management modes: defensive mode, passive mode, and strategic management mode. Management modes were categorized based on the enthusiasm and effectiveness of the management by core enterprises. For example, strategic management mode means that core enterprises actively manage and effectively improve the OHS of their suppliers. Next, characteristics and evolution model diagram of the three types of modes was established. Lastly, the model was explained.

The paper found that, at present, core enterprises in China have adopted three types of management modes: defensive mode, passive mode, and strategic management mode. The defensive mode is characterized by the cognition of the core enterprise to gain both justice and benefit, the motivation of strategy orientation, the strategy of systematic management and the result of sustainable SC. The passive management mode, on the other hand, is characterized by the cognition of passive responsibility, the motivation of public relations orientation, the strategy of ritual management and the result of moral hazard. The characteristics of the strategic management mode are the cognition of the core enterprise to gain both justice and benefit, the motivation of strategy orientation, the strategy of systematic management and the result of sustainable SC.

The paper supplements existing research, distinguishes, and distinctly characterizes different OHS management modes in SC based on the theoretical framework of "cognition-motivation-action/strategy-result". The innovation of this paper lies in the summary and recognition of OHS modes in SC by core enterprises in China. Characteristic model for different management modes from the existing case data were established using the grounded theory methods. As a result, the existing theoretical research involving the SC social responsibilities management and SC sustainable management by the core enterprise is supplemented. The theoretical model serves as the basis for subsequent research and expands the scope of application of grounded theory.

Equally, the paper provides a reference for the government to guide the core enterprises to evolve from a negative to a positive management mode and similarly provides a reference for the core enterprises to actively evolve to a positive management mode. Evolving from one mode to another requires a change in the corresponding combination of characteristics. In other words, the evolution of SC OHS management mode requires the simultaneous evolution of cognition, motivation, strategy and result, but the critical first step is the evolution of cognition. First, the government can improve the management cognition and management behavior effect perception of core enterprises by increasing external pressure. Secondly, increasing publicity and education to guide the core enterprises to integrate OHS management into the development strategy and serve the OHS management as a cooperative innovation mode. Then, calling on the stakeholders to cooperate with the core enterprises and thus improve their ability to take effective management measures. Finally, we may strive to achieve both justice and profit and maintain the sustainable development of the SC. Therefore, the government may change the management mode characteristics of core enterprises, and guide the core enterprises to evolve from defensive mode to strategic management mode.

The theoretical contributions of this paper are as follows: firstly, this paper creatively constructs three OHSM types and evolution model to characterize management modes of OHS in the SC by core enterprises in China. Secondly, this paper expands the "cognition-motivation-action/strategy-result" theoretical analysis framework, applies it to the exposition of pattern characteristics, and highlights the dynamics of pattern evolution, which is enlightening for the description of the evolution of enterprise management model in the future. Lastly, this paper finds that the key first step in the evolution from negative to positive model is the evolution of cognition, so the results of this paper have practical utility for governments to formulate relevant guidance strategies.

Like any conceptual model, our model has its limitations. First of all, the theoretical model of this paper is based on the analysis of the interview of core enterprises according to grounded theory, and there are no interviews on the response of SMSs to OHS management of core enterprises in SC. However, due to the premise that the more the core enterprises actively participate in the SC OHS management, the higher the OHS level of SMSs, it can be inferred that the more the core enterprises actively participate in the SC OHS management, the more the SMSs will actively respond to the management needs, and the higher the acceptance of the OHS management measures. Secondly, although the paper summarizes the types of management modes of OHS and their corresponding characteristics from abundant case materials, there are also some characteristics that exist in other materials. However, the paper has arguably summarized the most relevant aspects and major characteristics. This paper studies the characteristics of SC OHS management of core enterprises in order to explore the characteristics of positive OHS management to guide practice.

The next research direction is to stimulate the motivation of the core enterprises to actively participate in SC OHS management, namely, future research may select typical core enterprises for interviews on the basis of this current research and study the key driving forces for these enterprises to evolve from a defensive mode to a passive mode and eventually a strategic management mode, and test the effects of these key driving forces on OHS management in their SC by statistical analysis.

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## Ethics statement

This article does not include any experimental research involving humans or animals.

## Data availability statement

The data that has been used is confidential.

## CRediT authorship contribution statement

**Qiaomei Zhou:** Writing – review & editing, Writing – original draft, Funding acquisition. **Jingjing Zhang:** Validation, Supervision, Funding acquisition. **Qiwei Wang:** Project administration, Methodology, Formal analysis. **Jingjing Zhong:** Resources, Investigation, Funding acquisition.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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