



## ESTABLISHMENT AND GUARANTEE OF FOOD LOGISTICS SYSTEM FOR BIG SPORTS EVENT

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### ABSTRACT

This paper analyzed the detailed chains and agents involved in the food logistics framework at big sports event and pointed out the main problems which should be noticed in the logistics food framework. Finally, detailed measures of establishing food logistics security system and framework at big sports event were proposed.

### Keywords:

*Big sports event;*

*Food chain logistics;*

*Storage temperature control;*

*Food safety.*

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## 1. Introduction

The holding of big sports event has great significance upon the development of sports, a nation's economic and cultural advancement and the promotion of people's sportsmanship. Especially, the internationally big sports event can expand these influences into the whole world, and are important to improve China's international status. To achieve the above goals, ensuring the safety of food logistics at big sports events must be paid high attention by the organizers (Vlachos, 2014).

The security of food logistics at big sports event is not only directly related with the dietary health of all personnel, but also directly influences the performance of contestants. If any accidents caused by food logistics safety happened at any international big sports event held by China, any opportunity of China continuing to obtain the right to hold a similar event as well as the international influence shall be significantly negatively affected.

This paper analyzed the detailed chains and agents involved in the food logistics framework

at big sports event and pointed out the main problems which should be noticed in the logistics food framework. Finally, detailed measures of establishing food logistics security system and framework at big sports event were proposed.

## 2. Materials and methods

The food logistics at big sports event usually comprises two aspects, namely logistics of purchasing ingredients demanded by food production and logistics of distributing finished food products.

### 2.1. Security for the logistics of purchasing

Purchasing logistics is comprised of ingredients choosing, transportation and storage. Since it directly affects the quality and quantity of ingredients, it's the foundation for food logistics security at big sports event.

#### (1) Safety Guarantee for the Quantity of Ingredients

Big sports event usually involves people from different races, religions and regions, which makes greatly different demands for food, thus more types of ingredients are required. The organizers of big sports events must consider the

great differences in food requirements, and notice what ingredients can't be locally purchased or need special treatment. The quantity of ingredients purchased at other places or specially treated should be paid more attention so as to insure the corresponding requirements can be met.

**(2) Safety Guarantee for the Quality of Ingredients**

It mainly includes the quality of ingredients as well as quality of ingredients at the transportation and storage. After the purchasing contracts being established, the ingredients must be chosen according to the quality standards specified at the agreed purchasing contract. Then the ingredients must be transported to the warehouses of organizer as soon as possible, and distributed to the food manufacturer rapidly (Amani et al. 2013). The most frequently occurring problems at transportation and storage period are decomposition and secondary pollution of ingredients. On one hand, on the basis of shortening time required for transportation and storage, cold-chain transpiration & cold storage should be employed to prevent ingredients from being decayed. On the other hand, on the basis of guaranteeing basic food hygiene, different kinds of ingredients should be transported by dedicated vehicles to prevent them from affecting each other, resulting in secondary pollution (Durak and Ünverdi, 2014).

**2.2. Security of the Logistics for Distributing Finished Food Products**

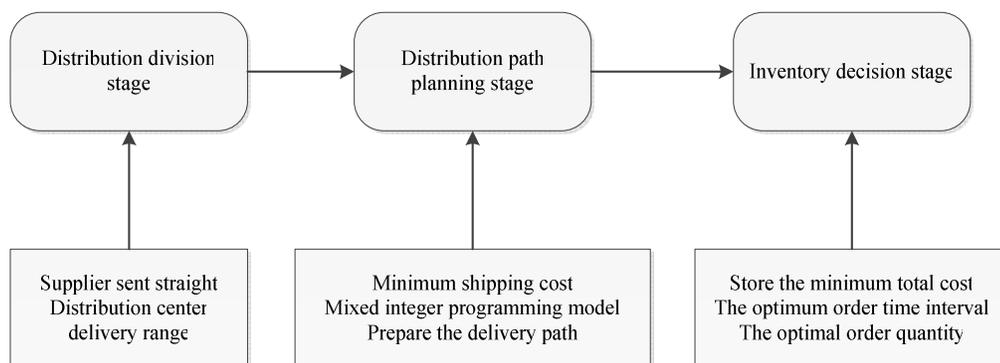
It means the process of finished food products being eventually distributed to contestants and other related personnel at big sports event, during which the quality and quantity of food should also be guaranteed. It's the final and the most important stage for guaranteeing the food logistics safety (Soysal et al. 2012).

**(1) Safety Guarantee for the Quantity of Distributed Finished Food Products**

If the ingredients have been purchased and manufactured according to the dietary habits of personnel attending the sports event, the total quantity safety of logistics for food distribution can be guaranteed. One of the major quantity safety issues is the quantity guarantee issue of food distribution both at different times and spaces, which involves learning in detail and scientifically arranging the different dietary habits, especially where and when these people with special dietary habit shall have their food. Different people should be guaranteed to have their desired and enough food at normal times and places.

**(2) Safety Guarantee for Distribution Process after Food Being Manufactured**

It mainly includes two aspects, namely transportation and storage. The most basic measure is to shorten the time required by these two processes as much as possible. For hot food, on the basis of shortening time required by storage and transportation, heat-preserving issue should also be pay much attention. However, for food of other sorts, to prevent them from being decayed and on the basis of shortening required time, the best way is to employ cold-chain transportation and cold storage(seen in Figure 1).



**Figure 1:** Big events logistics operation mode process

### 3. Results and discussions

Assumption: the sequence of the number of participants over the years in similar large-scale sports events

$$a^{(0)} = (a^{(0)}(1), a^{(0)}(2), \dots, a^{(0)}(n)) \quad (1)$$

To use accumulated generating transform data:

$$a^{(1)}(k) = \sum_{m=1}^k a^{(0)}(m) \quad k = 1, 2, \dots, n \quad (2)$$

To calculate the stage ratio variance of data, and determine whether it is suitable for the grey forecasting model, the relevant formula is as follows:

$$\delta(k) = \left| 1 - \frac{a(k-1)}{a(k)} \right| \quad (3)$$

If the stage ratio variance is in an admissible scale (0.1353, 7.389), the GM (1, 1) modeling can be done. After data processing and inspection, the number of future participants will be predicted, as shown in formula (4), (5).

$$a^{(1)}(k+1) = \left( a^{(0)}(1) - \frac{\beta}{\alpha} \right) e^{-\alpha k} + \frac{\beta}{\alpha} \quad (4)$$

$$a^{(0)}(k+1) = a^{(1)}(k+1) - a^{(1)}(k) \quad (5)$$

$$z^{(1)}(k) = 0.5(a^{(1)}(k) + a^{(1)}(k-1)) \quad (6)$$

$$C = \sum_{k=2}^n z^{(1)}(k) \quad (7)$$

$$D = \sum_{k=2}^n a^{(0)}(k) \quad (8)$$

$$E = \sum_{k=2}^n z^{(1)}(k) a^{(0)}(k) \quad (9)$$

$$F = \sum_{k=2}^n z^{(1)}(k)^2 \quad (10)$$

$$\alpha = \frac{CD - (n-1)E}{(n-1)F - C^2} \quad (11)$$

$$\beta = \frac{DF - CE}{(n-1)F - C^2} \quad (12)$$

After getting the number of future participants and the amount of arrived luggage from all participating delegations, with the grey forecast method, the average amount of carried luggage per person is necessarily required, whose influencing factors are divided into two kinds:

the inner factors of sports events, depending on demands and projects of sports events, for example, more equipment is needed in the Olympic Games than in an individual world championship or similar World Cup projects. More equipment is needed in winter games than in summer games; the external factors of sports events, mainly referring to the difference among participating countries, that is, the difference among sports equipment and luggage comes from the difference in the national economic level and emphasis degree (Morganti, 2011). For example, the average amount of carried luggage per person is 2.783 [1.333, 4.923] in the 21st university sports meeting of Beijing, and its deviation is 0.9727, which shows the difference is more obvious (Zunder et al. 2013).

According to the principle of homomorphism, because the large-scale sports events are mostly mature and relatively fixed, the amount of luggage is relatively fixed for similar sports events, and it fluctuates up and down with the national economic cycle and event influence (Ellinger, 2006). So, a simple average method is adopted to predict the average amount of luggage per person, as follows:

$$X_t = \left( \frac{1}{t-1} \right) \sum_{i=1}^{t-1} D_i \quad (13)$$

In order to get the average amount of luggage per person in current sports event, we only need the actual average amount of luggage per person for previous sessions. Therefore, the amount of arrived luggage from all participating delegations is as follows:

$$Y_t = aX_t = \left( \frac{a}{t-1} \right) \sum_{i=1}^{t-1} D_i \quad (14)$$

#### 3.1. Quality safety problems of food materials from individual suppliers

In general, the suppliers of food material must be some reputable supply companies of food material through strict certification in order to guarantee the quality safety of food logistics. Due to a variety of unplanned situations, some certificated companies still cannot completely meet the demands of food material supply. Under special circumstances, therefore, the

supplement of individual suppliers is required. With the lack of technical facilities and guarantee abilities of quality safety, there inevitably will be some problems in food material quality, especially the health conditions do not conform to the standard.

### **3.2. Storage temperature control**

Both the food material and the processed food should be stored for some time, if they can't be immediately eaten. In order to retain freshness, the food material generally requires hot storage for hot food or cold storage for cold food, for which the temperature should be controlled in a certain range (Pasternak and Pellissier, 2014). The equipment can automatically control the temperature in hot storage room or cold storage room, without absolute accuracy occasionally, which cannot meet the standard and lead to deterioration of food or food material if the disposal is not in time (Vander et al.2005).

### **3.3. Shortage of key equipment**

If the cold storage facilities and thermal sterilization equipment are input largely in one go, the processing will become difficult after events. In view of cost, the organizers reduce the purchase of these devices as far as possible. As the key equipment assuring the food logistics safety, the lack of cold storage facilities and thermal sterilization equipment will influence the efficiency of food logistics safety management. And for the efficiency, some necessary steps of food logistics safety are omitted, causing the potential security problems.

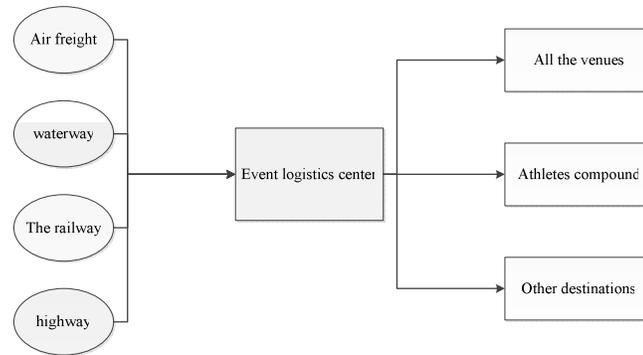
### **3.4. The insufficient staff of logistics safety management**

For the control power of the safety of food logistics, the large-scale sports events are far more than general group activities, which need a

lot of staff to meet the needs of strict safety management(Jack and Vander, 2009). Generally speaking, the organizers usually have a science arrangement for human, rarely suffering from understaffed problems. However, there exist some abnormal situations in the large-scale sports events (Vorst et al. 2005). For example, when the organizer's inspection agency of food material finds that a group of food material cannot meet the health indicator, in order to eliminate the potential safety problems it will deal with the unqualified food material, disinfection of the corresponding transport vehicles and personnel, etc, which largely increases the organizer's work. The peak of these abnormal situations will cause the insufficient staff of logistics safety management.

### **3.5 The health management of relevant volunteers and temporary employers**

The volunteers and temporary employers only attend the knowledge training about the food logistics safety, temporarily organized by the organizer. The training is very important for the food logistics safety ensured by them, but it is not enough to help them form a habit fully conforming to the safety standards of food logistics. In many large-scale sports events of China, some volunteers enter into work places without disinfection in accordance with the health regulations.. In order to keep the job, some temporary employers don't report to the higher level in accordance with the relevant provisions when suffer from the influenza, dysentery and other infectious diseases. The accidents of food logistics safety haven't appeared so far, though, the potential safety problems should be paid attention to by organizers, as is shown in Figure 2.



**Figure 2.** Event logistics center system traffic connection diagram

### 3.6. Unexpected problems caused by water, power and gas supply

The normal supply of water, power and gas is the most basic condition for the normal operation of food logistics in large-scale sports events, for which the construction should have been very mature in those cities holding large-scale sports events (An and Ruck, 1999). However, there are still some abnormal situations, such as the water-break, power-break, gas-break, water pollution and so on, which cannot meet the corresponding standard of food logistics safety. For the food logistics safety, if the abnormal situations of water, power and gas cannot be solved in time, it will be likely to cause the collapse of the food logistics safety system, resulting in a serious consequence. At present, the organizers have more rich experience in safety management of food logistics in large-scale sports events of China, which is conducted in strict accordance with the requirements of the HACCP management system, without big safety problems generally. But once some problems appear, some potential safety problems will accordingly appear, and even resulting in some bad safety accidents about food logistics, so the corresponding measures are expected for its prevention.

## 4. Conclusions

In large-scale sports events, we must place a strict safety control on links, subjects and potential problems of food logistics safety in accordance with the requirements of HACCP management strictly, in order to build a scientific

and effective system framework of food logistics safety. And we have to do the pre-arranged planning for all sorts of unexpected accidents to ensure the smooth progress of events.

### (1) To set up the leading agency with a unified management and coordination of food logistics safety.

The leading agency has a supreme power to manage and coordinate the safety of food logistics in large-scale sports events, and takes charge of building a safety framework of food logistics system and ensuring its normal operation, including the safety planning and managing supervision of all links and subjects involved by food logistics safety, formulation and audit of all management provisions, coordination with other relevant departments, disposal of abnormal situations, etc. The establishment of the agency can ensure a smooth operation of food logistics safety under the condition of unified management and coordination.

### (2) To set up an independent agency of health detection and disinfection for food logistics safety.

In addition to agencies of procurement logistics and food distribution, we required an independent agency of health detection and disinfection for food logistics safety. The agencies of procurement logistics and food distribution possibly don't disinfect the personnel and facilities in strict accordance with the provisions for their own interests or human saving, and for some existing problems or potential safety problems of food logistics, they

don't report to the superior and dispose them timely according to the regulations.

**(3) To establish a perfect training system of food logistics safety**

The food logistics safety training should not be limited to the temporary induction training of the staff in safety positions. In order to guarantee the employers and university volunteers to carry out food logistics safety ideologically, and form the correct behavior patterns, more training and education are required after induction, which can combine with the daily work meeting system, and can aim at specific problems to organize the small specialized training for the relevant staff. The system of continuous training combines with specific work closely, which is conducive to make the related personnel keep a profound impression and form a correct behavior of food logistics safety.

**(4) To improve the propaganda and education of food logistics safety to contestants**

As the direct consumers of food, the contestants are most concerned about the food logistics safety. We should improve the propaganda and education of food logistics safety to them, which can both make them take correct measures timely in food logistics safety accidents, avoid damage increase, and make themselves an important force in safety monitoring of food logistics. A method is provided for the curriculum education reform of food chemistry, based on the basic knowledge of food logistics safety for contestants, evaluation methods of the students' comprehensive quality and so on. So, a teaching effect is achieved, in which we can cultivate students' autonomous learning ability of food chemistry, personal ability, interpersonal communication ability as well as the whole CDIO ability.

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