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IT SUPPORT AND STATISTICS IN TRACEABILITY AND PRODUCT RECALL AT FOOD LOGISTICS PROVIDERS

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Abstract

There is a clear responsibility for food safety at all stages of the food chain. To maintain quality in logistics, several providers have built up the ISO 9001:2000 QMS, though in case of food logistics providers it does not fully guarantee food safety. The most effective method to prevent the different food-born diseases and provide food safety is the HACCP method.

HACCP and ISO 9001:2000 systems can be built up independently, but it is worth building up a combined, integrated system.

One of the principal elements of ISO and HACCP systems is traceability. It has extraordinary importance in distribution centres (DC) because of the large amount of products stored together. In a DC it is essential that the information attached to the products has always to be available when necessary. An electronic data interchange (EDI) technique assures for the service provider the required fast and easy traceability and the connecting statistical evaluation.

In our paper we discuss the properties of the EDI systems used in Tibbett & Britten Hungária Ltd, the different levels of recalls, the product recall procedure, the monitoring system with the corresponding sampling procedures and statistical data analysis.

Keywords: food logistics, EDI system, product recall, monitoring system, pre-delivery inspection, acceptance sampling, statistical data analysis.

1. Introduction

Tibbett & Britten Hungária Kft. is one of the leading Hungarian specialists for operating outsourced logistics services. Being a part of the international group of Tibbett & Britten companies, TBH provides warehousing, distribution and international supply chain management.

Our warehouse is a *shared user facility*, which means that several partners are served from the same Distribution Centre (DC). With this feature we can seek *synergies* in warehousing and distribution of several partners stock.

At Üllő site we have *multi temperature* warehouse (ambient, chilled, frozen), and we also do *value added services* (co-packing, labelling, promotional packaging). The appropriate product handling technology maintains flexibility, and fulfils

high care requirements of the clients. The supporting systems ensure full inventory traceability and control, which is achieved through radio frequency data terminal, bar code technology, on-line full pallet and case picking, and communication to vendors and customers through standard EDI connections [9].

2. EDI Systems

The EDI type of data transfer's main task is to reduce the high amount of paper-documents and to avoid a lot of administration work with the accompanying mistakes [7]. It is very important to investigate the safety features of this data transfer.

A logistical service provider's major task is to monitor goods received from customers at each point of the distribution chain, and to conduct interactions with high reliability – blocking and recall – as required by the customer.

The most important action is the recall, which takes place if the producing company produced and/or put a product on the market that fails to meet the quality requirements, threatens the health of the consumers and/or jeopardizes the goodwill of the company. In this particular circumstance, it may be necessary to recall the relevant products from the market.

3. Types of Recall

The *level of recall* represents the various phases in the distribution chain where a product can be retrieved. We distinguish the following levels of recall [8, 10]:

1. in house,
2. warehouses and DC's,
3. stores/professional users,
4. customers.

Depending on the incident category and level, a company may initiate:

1. public recall (the general public is informed), or
2. silent recall (the professional third party contacts are informed e.g. transporters, warehouse managers, retailers, caterers, but not the general public).

Recall categories constitute a classification scheme for incidents, according to their inherent hazards to public health, the brand of a product and the reputation of a company. The classification of an incident predetermines the alternatives of a company in dealing with it.

4. Monitoring

When receiving goods a unique identification number is assigned to each pallet of goods. The WMS assigns the information of the relevant product to the unique identification number. Electronic information is received on products (via EDI) based on a special agreement made with the partner, which is linked to the pallet in question by reading the bar code on the product. In other circumstances, the goods are stored with PO, when a warehouse keeper writes the key information to a 'Data Sheet' to be stored in WMS as well.

In case the unit of the product is identified by means of a bar code label placed on it by the producer, the warehouse keeper reads the bar code by means of the bar code scanner that is automatically entered into the WMS. The warehouse prints its own identification label that includes SKU, date of production or expiry, name of product, unique pallet identification number, case number, location, name of the person who is responsible for the intake, and date of receipt.

In case the product is subject to LOT codes, then in this particular circumstance more than one pallet may belong to a single LOT. When taking the goods in, the LOT number is also assigned, and WMS assigns internal identification numbers for each pallet.

From this point of the process, each delivery unit always carries a system-generated unique identification number in the computerized system and the applied warehouse technology follows the unit all the time until the delivery takes place. In case a pallet is disintegrated in the course of the process (picking), the system generates a new pallet identification number and assigns it to the previous one, ensuring identification in this way.

It really facilitates tracing, if booking happens not after product handling, but at the same time. In the opposite case, an administrator processes the attaching documents by computer a couple of hours later than the product was transferred to another place. This means that almost after each moving or changing of the status of a pallet, booking occurs later, so the pallets are not on the place or in the status that WMS shows. An effective method to eliminate this problem is, if on-line booking is applied in the warehouse, which means that moving goods in the warehouse and booking at both the warehouse and the picking areas simultaneously take place. This makes it possible to identify that a case is assigned to the pallet identification number upon which the order has been picked. Thus, goods can be monitored even on case level with high reliability.

Accordingly, computerized databases and unique identification numbers of items ensure monitoring.

5. Product Recall Procedure

DC has to respond to product recall immediately, delay can cause serious consequences.

Recall process may be performed in the easiest way by means of a special program in the WMS.

In case of searching for items, the SKU number of the product is given, apparently either the date of storage-in or the date of production or the bar code or the LOT code may be determined (or the relevant interval of each), and then the search can be performed for those items.

Then the program finds the pallets meeting the search criteria and the related historical data.

6. Response to Recall

Taking the simplest case, pallets to be recalled *are still in the distribution centre's warehouse.*

In this particular case, on the basis of WMS data, a responsible person may immediately block those pallets in compliance with the instructions of the customer.

In case pallets identified by their pallet identification number are no longer in the warehouse *but have been delivered out of the warehouse as a complete pallet delivery package*, it can be identified, when and where they have been transported (date, booking records, quantity delivered, address of delivery, disposition number and identification numbers of the related vouchers).

Another case is when the identified pallets *have been delivered out of the warehouse with picking*, i.e. goods first have been taken to the picking area, then picked cases belonging to a pallet can be identified by disintegration of the pallet. If on-line picking procedure is applied in the warehouse, it can be unambiguously identified if a certain pallet has been transferred to the picking area and when, where and how many cases have been delivered (date, booking records, quantity delivered, address of delivery, disposition number and identification numbers of the related vouchers).

When pickers do picking inadequately, the FIFO principle and traceability can be corrupted, some cases can get stuck in their picking location. To eliminate this problem, the picking locations are checked continuously.

Due to human factors it can be set in the program that a recall relates not only to the cases of the pallet subject to search, but also to those that have been placed prior and subsequently to the relevant picking location. It can be set on the computer that plus/minus how many pallets are in the recall list.

A food-logistics service provider has to maintain a Product Recall procedure. The Recall procedure is a mandatory regulation even in case if there is no foodstuff in the warehouse, because the customer can require recall activities any time.

7. Pre-Delivery Inspection

Pre-delivery inspections are carried out on the basis of data from the WMS. This internal picking and checking list shows the items ordered by the customer and this serves as basis to the delivery note.

There are several methods, which can be applicable in a warehouse to check the complete cargo before dispatch. We examined the statistic-based pre-delivery

inspection, whether it can substitute the total final quality control or not. If suitable, it would decrease costs of control and cut the time of dispatch, while ensures the appropriate extent of producer's and customer's risk.

The benefit of this programme is, that it must be confident that the case-fill rate (one of the major statistical KPI in a DC – the ratio of cases in deliveries, which are correctly performed) is within a certain pre-defined limit. This requires management systems and operational procedures, which demonstrate the very highest levels of quality.

The method specifies a two-stage approach. Firstly (quality assurance): this involves the establishment and monitoring of quality management systems and operational procedures before and during the warehousing process (as it was mentioned in the previous chapter). Secondly (quality control): it involves the inspection of the final dispatch by sampling.

Acceptance sampling distinguishes the acceptable and the unacceptable lots, and the decision to accept or reject an entire lot is based on observations made on a sample taken from the lot (see *Fig. 1*). Acceptance sampling is a quality assurance technique used for inspecting incoming material and outgoing (finished) products. A common question quality control engineers face is to determine the number of the items from a batch (e.g. picked load in a warehouse) to inspect in order to safely decide whether the items (products) in that batch are of acceptable quality. ISO 2859-0; ISO 2859-1 standards [4, 5] (sampling procedures for inspection by attributes) are dealing with this question.

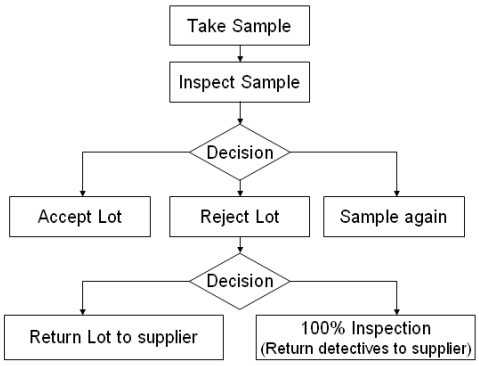

Fig. 1. Acceptance sampling

The sampling procedures are useful whenever we must decide whether or not a batch or lot of items complies with specifications, without inspecting each item in the batch. As *Fig. 2* shows, an obvious advantage of acceptance sampling over 100% inspection is that reviewing only a sample requires less time, effort, and money.

Acceptance sampling will require the selection of a *sampling plan* which will determine the size of a sample and the number of defectives permitted in the sample for the decision of acceptance or rejection of the whole lot.

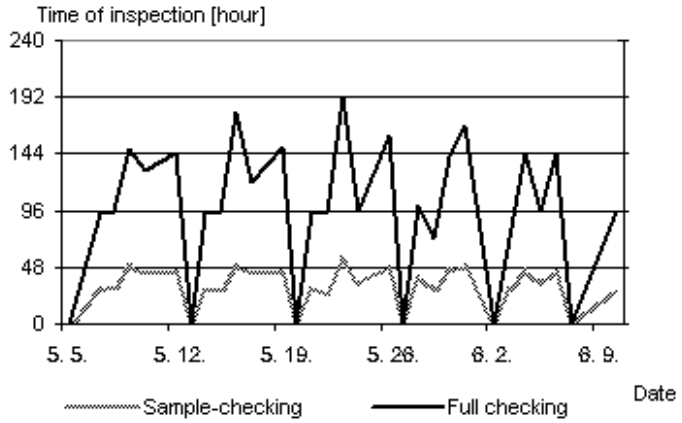

Fig. 2. Time of inspection with or without acceptance sampling in 2003 May-June

8. Operating Characteristics Curves

Operating Characteristics (OC) curves [1] are graphs for the representation of sampling plans. They show how well a particular sampling plan separates the good and the bad lots. These graphs show the probability of accepting a lot versus the percentage of defectives in the lot.

The effectiveness of acceptance sampling depends on the parameters of the sampling plan [6], namely the sample size (n) and the permitted number of defectives (Ac). *Fig. 3* shows only the effect of sample size (n). The effect of acceptance number cannot be seen here, because the same acceptance number was used for A, B and C curves. However, it is obvious that the OC curve becomes steeper with larger n and smaller acceptance number. An ideal OC curve is obtained by 100% inspection.

In case of a DC, where the case-fill rate is more than 99.9%, the Acceptance Quality Level is quite low. The other important parameter is the lot size. We can choose different sizes according to the shifts, sectors, full- or picked pallets, various cargos or customers. If we would like to effectively discriminate between the good and bad lots, we should apply tightened inspection (see *Fig. 3*, curve A), which requires the largest sample size and the steepest OC curve and also has the best discriminatory ability. The reduced inspection (see *Fig. 3*, curve C) on the other hand, uses the smallest sample size and the least steep OC curve, and therefore has the worst discriminatory ability.

The biggest problem is that if we choose a large lot (pallets of a whole shift/sector) we cannot retain the whole lot until the sample examination is completed, because the outgoing vehicles carry them continuously to the customers, right after a cargo has completed. But if we choose just a cargo as a lot, we will have much smaller sample size and consequently much worth selectivity.

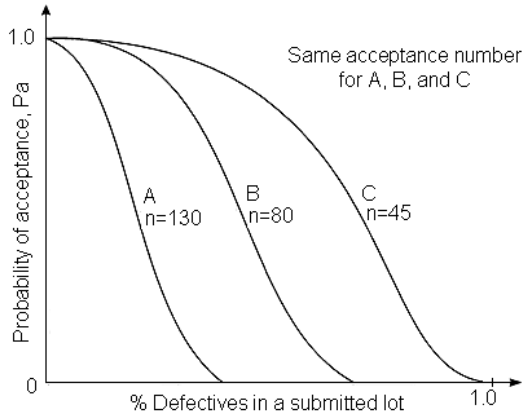

Fig. 3. OC curves

To avoid these problems we have investigated the possibility to change our sampling policy. The main idea of the new method is a full scale statistical evaluation of the consumers' complaint first, beside the control of the quality described above. If we consider the fact that the probability model for attributes data is the Poisson distribution, where the ratio of defective items (p) approaches to zero and the sample size (n) tends to infinity, it is obvious that the full scale statistical evaluation of consumers' complaint will reduce the sample sizes to the same level of AOQL, AQL and LPTD.

9. Discussion

Food market requires to ensure that only safe food, which is acceptable for human consumption, is placed on the market.

A logistical service provider's major task is to monitor received goods at each point of the distribution chain and to conduct interactions with high reliability blocking and recall, as required by the customer. Here we mentioned only one factor that affects food safety, the IT-supported recall method, which is a common part of HACCP and ISO 9000 systems [2, 3] and which takes place if the producing company produced and/or put a product on the market that fails to meet the quality requirements, threatens the health of the consumers and/or jeopardizes the goodwill of the company. We mentioned a modern method of data transfer (EDI), which can minimize human errors and mistakes. We have reviewed a possible monitoring system and recall activity.

Based on a well-developed WMS filled up with reliable and accurate information (via EDI system), different actions like monitoring, recall or final checking can be performed with high reliability. The system carries all informations, which are necessary for these actions, until delivery takes place.

Regarding pre-delivery inspection, in case the required case-fill rate is too high and the lot available at a time can be retained until sample examination is completed, is too small there is no way to do acceptance sampling method. In this case the total or nearly total examination is necessary, even if it has much higher cost.

10. Acknowledgements

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List of Symbols

Ac	Permitted number of defectives
AOQL	Average Outgoing Quality Limit
AQL	Acceptance Quality Level
BUTE	Bp. Univ. of Technology and Economics
DC	Distribution Centre
EDI	Electronic Data Interchange
FIFO	First In First Out
HACCP	Hazard Analysis, Critical Control Points
IT	Information Technology
KPI	Key Performance Indicator
LOT	Batch
LTPD	Lot Tolerance Percent Defective
n	Sample size
OC curve	Operating Characteristics Curve
PO	Purchase Order
QMS	Quality Management System
SKU	Article number (Stock Keeping Unit)
TBH	Tibbett & Britten Hungária Kft
WMS	Warehouse Management System

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