

Development of Quality Assurance Critical Control Point (QACCP) System for International Fashion Supply Chain Management

Zhimin Chen^a, Ji-young Ruckman^a and Richard Murray^b

^a *Department of Clothing Design and Technology, Manchester Metropolitan University, Hollings Faculty, Old Hall Lane, Manchester, UK, M14 6HR*

^b *Manchester Metropolitan University, Hollings Faculty, Old Hall Lane, Manchester, UK, M14 6HR*

Abstract

Quality issues in international fashion supply chain may arise from information loss and/or misunderstanding in transferring information from one organization to another. It is important and necessary to establish a comprehensive and secure communication system in international fashion supply chain management to eliminate information loss and ensure information can be transferred correctly. According to Chen *et al* (2004) specifications are used as a means of communication between buyers and sellers of products; between the manufacturers and contractors; between management and production workers; between designers, pattern makers, and samples makers; and among the divisions of a clothing firm. They state that inadequate specifications are the source of many problems. Quality standards are essential in order to produce quality food product. The Hazard Analysis Critical Control Point (HACCP) System used in food industry is also concerned with quality management, primarily safety. It is a powerful practical tool for formally identifying hazards in the food supply chains. Macdonald and Engel (2001) state that HACCP is a preventative system which can be used to control everything - raw materials, incoming supplies, preparation, storage, processing, transportation and operations. Several researchers suggest that QACCP system, an extended concept of HACCP system designed to manage quality assurance for food safety, could be a powerful practical tool for formally identifying hazards in any industry. In this study seven HACCP principles given by Mortimore and Wallace (1998) were followed to demonstrate how a QACCP system may be developed for the Sample Development and Approval process between the UK Retailer F and Chinese Shenzhen Manufacturer. Information required for the development of the system was collected from partly structured, part-standardised, part open-ended interviews with representatives of the companies. It is also shown in this study how the developed QACCP system may be verified to confirm that the system is working efficiently.

Keywords: Fashion Supply Chain, Quality Assurance, Specification and Communication

1. Introduction

Quality issues in international fashion supply chain may arise from information loss and/or misunderstanding in transferring information from one organisation to another. It is important and necessary to establish a comprehensive communication system in international fashion supply chain management to eliminate information loss and ensure information can be transferred correctly. Both specifications and quality standards are essential in order to produce quality product. Glock and Kunz (2000) comment that quality specification in the clothing industry must describe and illustrate the final appearance expected for each style and each operation. They include stitch and seam types, stitches per inch, equipment requirements and critical dimensions, and tolerance for placement and alignment of stitching, seams, trims, and the machines for each operation as developed by clothing engineers and technical designers. According to Chen *et al* (2004) specifications are used as a means of communication between buyers and sellers of products; between the manufacturers and contractors; between management and production workers; between designers, pattern makers, and samples makers; and among the divisions of a clothing firm. They state that inadequate specifications are the source of many problems.

Quality standards are also essential in order to produce quality food product. The Hazard Analysis Critical Control Point (HACCP) System used in food industry is concerned with quality management, primarily safety. Macdonald and Engel (2001) state that HACCP is a preventative system which can be used to control everything - raw materials, incoming supplies, preparation, storage, processing, transportation and operations. Several researchers suggest that HACCP could be a powerful practical tool for formally identifying hazards in any supply chain. Mortimore and Wallace (1998) state that although HACCP was designed and used to identify all hazards for food safety its techniques are flexible and therefore can be applied to other areas such as product quality, work practice and to products outside the food industry. Forday (1995) recommends practical ways of applying HACCP by suggesting the sequence of steps for the development of a HACCP program. Dillon and Driffith (2001) suggest that HACCP can be incorporated into ISO 9000 or Total Quality Management.

Quality Assurance Critical Control Points (QACCP) is an extended concept of the HACCP System focusing on the management of quality assurance. The QACCP System was initially designed to complement HACCP by identifying Critical Control Points in quality

assurance systems in food production (Mortimore and Wallace, 1998 and Codex, 1997). The present paper demonstrates how principles of HACCP may be applied when developing a QACCP system in international fashion supply chains.

2. Methodology

To demonstrate the ways in which HACCP principles may be applied to an international fashion supply chain between the UK and China, first the supply chain between “Retailer F” and “Shenzhen Manufacturer” was selected. This selection was made based upon a previous study by Chen *et al* (2004) in which they identified a variety of supply chain models in operation between UK fashion retailers and Chinese clothing manufacturers. The selected supply chain has been identified in their study as a “Streamlined Supply Chain Model” developed by the UK retailer to work directly with the Chinese manufacturer. This streamlined model between “Retailer F” and “Shenzhen Manufacturer” is mature, having been in operation since 1998. According to Chen *et al* (2004) both parties believe that for Chinese clothing manufacturers to become successful in the direct export of clothing to the UK market this streamlined model is a possible way forward. The details of the companies are shown in Table 1.

Table 1
Company Information

Company	Type of business	Number of employees	Production/ export/import capacity*	Implementation of TQM and ISO 9000 QA System
Retailer F	UK Retailer	7,000	Various quantity per order: 150 – 4,000 pieces per item	Quality manual AQL Level II 2.5% (major defect) AQL Level II 4.0% (minor defect)
Shenzhen Manufacturer	Chinese Clothing Manufacturer	1,000	1,000,000 pieces per year	TQM ISO 9001 QA System

* All information given is for financial year 2003-2004

It was further decided to select a process within this supply chain rather than the whole range of processes because it is simpler to demonstrate how a QACCP system can be developed based on HACCP principles. There are currently five processes in this supply chain; Design Development, Sample Development and Approval, Fabric and Trims Order and Approval, Bulk Production Management, and Shipping to the UK & Warehouse Management in the UK. According to the previous study by Chen *et al* (2004) communication between “Retailer F” and “Shenzhen Manufacturer” is a challenge to both parties, especially in interpreting specifications, standards and quality information in Sample Development and Approval. In addition, Tyler (2003) also comments that although sample making has been part of the service that manufacturers provide to their customers for many years, if different aspects of new product development are carried out at a distance, the quality of communication about any innovation is impoverished. It was therefore decided that the Sample Development and Approval process should be selected for this study.

Seven HACCP principles given by Mortimore and Wallace (1998) were followed to demonstrate how a QACCP system may be developed for the Sample Development and Approval process between “Retailer F” and “Shenzhen Manufacturer”. Information required for the development of the system was collected from observations made during the visit to “Shenzhen Manufacturer” and also from face to face interviews conducted with the QA Manager of “Retailer F” and Merchandising Manager of “Shenzhen Manufacturer”.

3. Application of HACCP principles in the development of a QACCP system in an international fashion supply chain

Principle 1 - Conduct a hazard analysis

According to the first principle of HACCP a process flow diagram needs first to be developed in order to conduct a hazard analysis. For this study, the process flow diagram previously constructed by Chen (2005) for the Sample Development and Approval process in the international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer” was used as a starting point. Based on this flow diagram any hazards associated with each process step were identified. An example is shown in Table 2.

Table 2
Hazard Analysis in Step 1
(UK Retailer Prepares Sample Specification with Design Sketches)

Hazards	Responsibility
1. Sample Specifications and Design Sketches (in English)	1. UK retail buying team prepares sample specifications and design sketches:
1) Description of design	1) Designer prepares design sketches and design description
2) Design sketches – front view, back view, side view and design details	2) Fabric technologist prepares fabric specification
3) Presentation of specifications:	3) Garment technologist prepares trims specification
3.1) Size Specifications – detailed measurements and indicating correct position for each measurement	
3.2) Fabric Specification – fibre contents, fabric structures, colour and shrinkage (fabric swatches attached before and after wash)	
3.3) Trims Specification – sewing thread (type, size and colour), individual label details, button size & colour, zipper (size, colour and material), lining details, interlining detail (type, structure and usage details), packing materials (all trims samples attached)	

Principle 2 - Determine the Critical Control Points

The processes and procedures that can control hazards are termed Critical Control Points (CCPs). According to the second principle given by Mortimore and Wallace (1998) a Critical Control Point is a step where control can be applied and where it is essential to prevent, eliminate or reduce a hazard to an acceptable level. It is considered that determination of the CCPs is at the heart of HACCP. For the identification of the CCPs in HACCP a useful tool termed the “Decision Tree” is frequently used. Chen (2005) has previously demonstrated how the CCP Decision Tree approach may be applied to the Sample Development and Approval process in the international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer” by asking five general questions using the phrases of the Codex Committee (1997), but substituting the term ‘corruption’ for ‘contamination’ as shown in Figure 1.

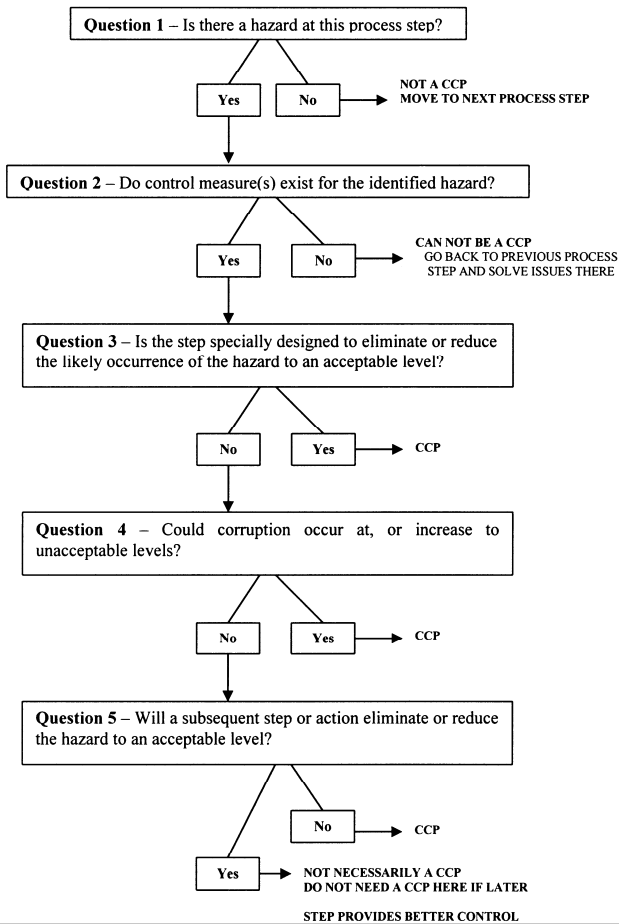
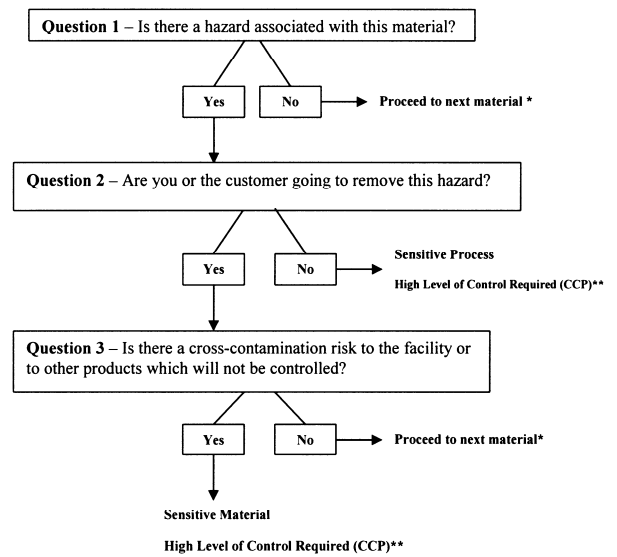


Figure 1 CCP Decision Tree for Sample Development and Approval (Chen, 2005)

Using quality raw materials in food production is crucially important to food safety and consumer health. Quality raw materials such as fabrics and trims are important to produce quality clothing. Therefore, before the actual production, it is important to focus on the raw materials CCP first at the development stage. In the past, there were cases where the wrong fabrics were supplied to “Shenzhen Manufacturer” due to information loss in communication between “Retailer F” and fabric supplier via “Shenzhen Manufacturer”. A mistranslated fabric specification yielding the wrong fabric specification or corrupted information transfer to the fabric supplier has also happened in making the fabric order. For this reason, the raw materials (fabric and trims) control Decision Tree for the international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer” shown in Figure 2 was suggested in this study. For example, general fabric defects such as colour shading, broken filaments, loom fly, cockled yarn, knots, mixed end, mixed filling yarn, density, broken picks and skipped ends are hazards to incoming fabric uniformity. Also, if different colour fabrics arrive at the same time, cross-contamination of colour is a risk in the fabric store, in cutting operations, sewing operations, and pressing and finishing.



Notes: * Proceed to next process; ** This process must be managed as a CCP

Figure 2 Raw Material Control Decision Tree

Table 3
CCP Determination in Sample Development and Approval (Chen, 2005)

Processes	Hazards	Q 1. Is there a hazard at this process step?	Q 2. Do control measure(s) exist for the identified hazard?	Q 3. Is the step specially designed to eliminate or reduce the likely occurrence of the hazard to an acceptable level?	Q 4. Could corruption occur at, or increase to unacceptable levels?	Q 5. Will a subsequent step or action eliminate or reduce the hazard to an acceptable level?	CCP Number
Step 1	IS	Yes	Yes	Yes	Yes	No*	CCP 1
Step 2	ITR and UQS	Yes	Yes	Yes	Yes	No*	CCP 2
Step 3	CI, IL, MI, MT, MU and HE	Yes	Yes	Yes	Yes	No*	CCP 3 E
Step 4	MU, HE (Pattern Cutter Mistakes) and QD	Yes	Yes	Yes	Yes	No*	CCP 4
Step 5	IS (Ordering Mistakes) and HE QD (Supplier Mistakes)	Yes	Yes	Yes	Yes	No*	CCP 5
Step 6	IS (Ordering Mistakes) and HE QD (Supplier Mistakes)	Yes	Yes	Yes	Yes	No*	CCP 6
Step 7	HE (Patter Cutter Mistakes), UQS and QD	Yes	Yes	Yes	Yes	No*	CCP 7
Step 8	HE (Sample Sewing Operator Mistakes), UQS and QD	Yes	Yes	Yes	Yes	No*	CCP 8
Step 9	HE (QA Mistakes) CI, MI, IL, MU and MT (Merchandiser Mistakes)	Yes	Yes	Yes	Yes	No*	CCP 9 E
Step 10	IL, CI and HE WA (Buyer/QA/Garment Technologist Mistakes)	Yes	Yes	Yes	Yes	No*	CCP 10

E – English Language Issues.

To determine CCPs in Sample Development and Approval process in international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer” all information presented during the data collection were considered. Information communication and quality defects are the key issues within the

fashion supply chains. Chen (2005) has shown in his study how the definitive CCP Determination Chart for Sample Development and Approval can be presented. This is shown in Table 3.

Principle 3 – Establish Critical Limits for Control Measures

Once CCPs are determined, HACCP principle three suggests establishing critical limits for control measures associated with each identified CCP. Control measures means factors, actions or activities which can be used to prevent, eliminate or reduce to an acceptable level any hazard. Corrective actions mean actions to be taken when the results of monitoring at the CCP indicates loss of control.

Principle 4 – Establish a system to monitor control of CCP

Mortimore and Wallace (1998) claimed that a QACCP team needs to be set up for the implementation of QACCP. They also mentioned that the early involvement of senior management is fundamental to effective implementation of QACCP. In streamlined international fashion supply chain management, as a minimum the core QACCP team would consist of experts with the following knowledge and experience: clothing/fashion design, clothing/fashion buying and merchandising, garment technology, pattern design and technology, quality assurance, production planning and engineering, information technology, clothing and textiles materials, international fashion business management and marketing. Once the QACCP Team is set up, training becomes the single most important element and should provide a good induction to QACCP principles and their application. Training not only offers QACCP knowledge with additional support skills such as QACCP planning, team working, and communication skills, it also helps in changing attitudes.

Principle 5 – Establish the corrective actions to be taken when monitoring

According to the fifth principle of HACCP the control measures and corrective actions for each step need to be drawn up based on information communication and quality assurance. An example of suggested corrective actions for Sample Development and Approval in the international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer” is shown in Table 4.

Principle 6 – Establish procedures to verify that the HACCP system is working correctly

Once the corrective actions to be taken when monitoring are decided, the next step is to establish procedures within the supply chain to ensure the newly-developed system is working correctly. For this study, a procedure for the supply chain between “Retailer F” and “Shenzhen Manufacturer” was created as shown in Figure 3. It indicates the quality management system within the streamline fashion supply chain between “Shenzhen Manufacturer” and “UK Retailer F” and provides the detailed communication flow within the supply chain.

Table 4

Corrective Actions for Step 1
(UK Retailer Prepares Sample Specification with Design Sketches)

Control Measures	Corrective Actions
1) Training programme in communication skills	1) Inform relevant departments internally in the UK and make amendment immediately if information has not been sent
2) Training course in writing design specifications and illustrating design sketches in production style	2) Inform Chinese manufacturer merchandising department immediately and make amendment if information has been sent
3) Develop a comprehensive and clear Standard Specification Form	3) Use video conferencing or digital images in showing the changes and presenting design details to Chinese manufacturer
4) Provide relevant sample for Chinese manufacturer, supply fabrics and trims samples with details	4) Improve internal and external communication skills
5) Using simple sentences and diagrams in presenting specifications, such as measurements and design details	
6) Use video conferencing or digital images in presenting design details or the parts may made confusion to Chinese manufacturer	

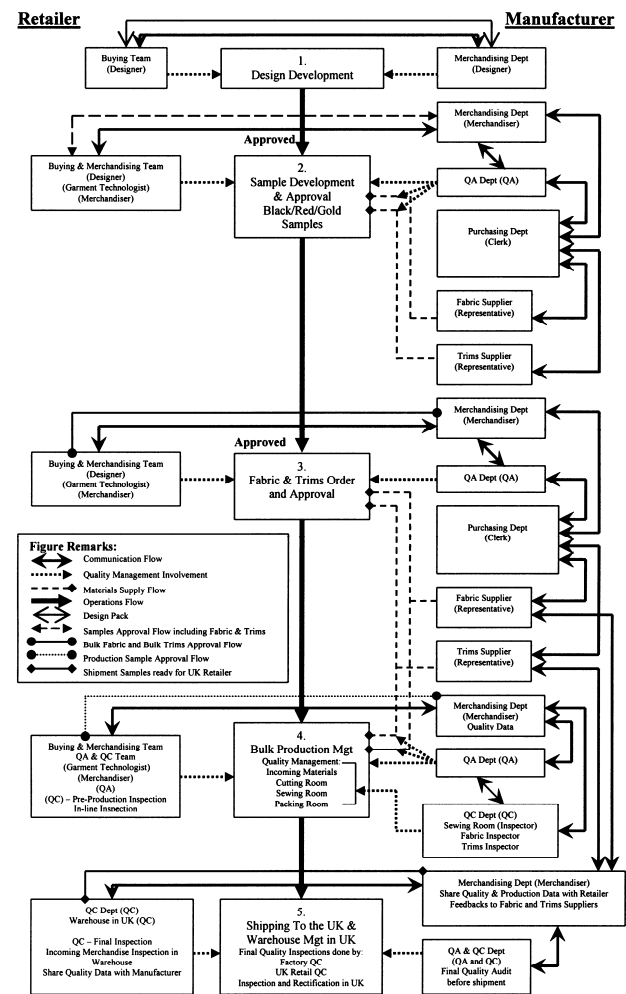


Figure 3 Quality Management and Communication System In Streamlined International Fashion Clothing Supply Chain Management

Principle 7 – Establish documentation concerning all procedures

The last principle of HACCP suggests the establishment of documentation concerning all procedures, hence there are documentation needs to be considered to complete the development of a QACCP system in the international fashion supply chain between “Retailer F” and “Shenzhen Manufacturer”.

This should be based on the established procedures shown in Figure 3.

4. Conclusions

The Hazard Analysis Critical Control Point (HACCP) System used in the food industry is a powerful practical tool for formally identifying hazards in its supply chains. QACCP is an extended concept of HACCP system designed to manage quality assurance for food safety, but its principles are applicable to other businesses. In this study, a demonstration of hazard analysis in the Sample Development and Approval process of the international fashion supply chain between “UK Retailer F” and Chinese “Shenzhen Manufacturer” was conducted to show how a QACCP system may be developed from identified potential hazards.

5. References

- [1] Chen Z. (2005) “Communication in International Clothing Supply Chain Management between Great Britain and China”, *Proceedings of 84th Textile Institute World Conference USA*, The Textile Institute.
- [2] Chen Z., Murray R. and Ruckman J. (2004) “Quality Control in International Clothing Supply Chains”, *Proceedings of 83rd Textile Institute World Conference China*, The Textile Institute.
- [3] Codex Committee on Food Hygiene (1997) *HACCP System and Guidelines for its Application*, Annex to CAC/RCP 1-1969, Rev 3, in Codex Alimentarius Food Hygiene Basic Texts, WHO, Rome.
- [4] Dillon M. and Driffith C. (2001) *How to HACCP – A Management Guide*, M.D. Associates, Grimsby
- [5] Forday W. L. (1995) “The Hazard Analysis Critical Control Point System”, *Singapore Microbiologist – Microbiology and Biotechnology News*, July-September, pp. 7-13.
- [6] Macdonald D. J. and Engel D. (2001) *A GUIDE TO HACCP – Hazard analysis for small business*, Highfield Publications, Doncaster.
- [7] Mortimore S. and Wallace C. (1998) *HACCP – a practical approach*, An Aspen Publication, Gaithersburg.
- [8] Tyler D. J. (2003) “Will the real clothing industry please stand up!”, *Journal of Fashion Marketing and Management*, Volume 7, Number 3, pp. 231-234.