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Comparative Study on QMS at Pre-Production Stage in China and UK Baby Dairy Product Industries

Qingxin Chen[1*], Huihui Shi[2], Liben Jiang[3]

[1]Jinan University, Guangzhou, China
[2]Huangpu Yumu Experimental Kindergarten, Guangzhou, China
[3]University of Central Lancashire, Preston, UK
Email: *qxchen0102@gmail.com

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Abstract

This research examined the Chinese baby dairy industry between 2008 and 2019, focusing on the quality management system with comparison between the UK and Chinese baby dairy product (BDP) companies. This study was conducted with a selection of four Chinese and two UK companies as case studies where interviews were used to collect the primary data. Moreover, focus group with company's managers and government officials and site visits were also carried out. The collected data were analysed through thematic analysis technique. This research has concluded that in the Chinese BDP industry many challenges are encountered, such as animal management, farmers' orientation towards quality assurance and implementation of quality standards. It has been found that it is important to focus on the pre-production stage for the best quality in final products. The comparison with the UK BDP industry has shown that it is better able to manage its quality with involvement of the majority of supply chain actors through electronic information sharing and traceability system, which are lacking in Chinese industry. It is also concluded that Chinese government has started to adopt practices such as strong enforcement of legislation which are improving the quality issues. The present study has important theoretical and empirical contribution in the existing literature. It has developed a framework about pre-production phase which will become foundation of future studies. The comparison of Chinese and UK BDP is also a contribution as previous studies have not done so. It has provided guidelines to managers about implementation of Quality Management System (QMS) in BDP hence managers have become better able to manage the quality.

Keywords

Quality Management System, Comparative, Baby Dairy Product Industry

1. Introduction

The baby dairy product (BDP) industry is snowballing all over the world (Johanson & Kao, 2015) and China is not an exception. During the last three decades, this industry has expanded dramatically with the support of Government in the form of subsidies and relaxed policies as incentives and also fuelled by the increasing demands from Chinese families. However, the product quality was neglected at large (Chen et al., 2013; Lu et al., 2014; Sharma & Rou, 2014). There have been reported incidents between 2008 and 2017 in which various companies in this sector have been found guilty of selling contaminated products (Wu et al., 2018). The most notorious incident was the 2008 Melamine Scandal, in which melamine was detected in the formula milk powder produced by Sanlu Group. This increases the apparent protein content, but led to severe health problems for around 294,000 infants in China (most were in rural areas), including six reported deaths (Jacobs, 2008). Other than Sanlu, many other incidents have taken place in recent times, highlighting the quality related issues (see **Table 1**).

Those incidents caused public panic on the domestically produced BDPs and customers' trust in the products' quality deteriorated substantially. The demand for domestic BDPs reduced significantly, leading to the overall financial loss of around CNY 20 billion (equivalent to GBP 2.23 billion) in the industry (Handford, Campbell, & Elliott, 2016).

After those incidents, a thorough investigation, led jointly by the companies involved and central and local governments, was carried out. Initial outcomes fell into the field of quality management (QM) and its systems (QMS), especially lack of proper quality control and supervision systems, and the weak capacity of the government department to regulate the BDP industry properly (Kwan & Lam, 2016). For example, the pre-production stage encounters the problems related to dairy farms, farmers, raw materials, inspection, technology and management. Farmers do not have the orientation towards assuring the quality of the raw material and they also do not have any formal procedures and technology for this. Due to the growing awareness among consumers about food safety, the Chinese government and companies were forced to reform the quality management system and tried hard to win the customers' trust back (Kim, 2013).

There was active research carried out on quality management in BDPs and a wider range of food products in general after 2000, and reports (Enderwick, 2009; Qian et al., 2011) showed that the Chinese food industry mainly focused on the profits and had neglected quality management. There was no serious action taken by the industry and governments to improve the quality until the

Table 1. Quality related incidents in the baby dairy industry of China.

Year	Incident	Involved companies
2008	Melamine Scandal. Melamine was detected in the formula milk powder. Other well-known companies were also found to have used melamine to increase the apparent protein content of products.	Sanlu Group, Inner Mongolia Yili Industrial Group, Inner Mongolia Mengniu Dairy Group, Bright Dairy & Food Co., Ltd, Synutra International Inc, Yashili International Group Co., LTD and so on. In total, over 20 companies were involved.
2009	BDPs were contaminated by a prohibited carcinogen, flavacin M1, which is a food mould that can cause severe liver damage or even liver cancer.	Inner Mongolia Mengniu Dairy Group.
2011	Products were found to contain an excessive amount of aflatoxin that can cause liver cancer.	Bright Dairy and Hunan AVA Dairy.
2013	The sale of out-of-date infant formula milk. Infant formula milk, which had passed its use-by date, was repackaged and sold under the brand name of Hero Nutradefense infant formula.	Xile Lier import and export company.
2015	It was detected that aflatoxin M1 in the infant formula milk powder exceeded the standard.	Shanxi Gucheng Dairy Group Co., Ltd.
	Companies found to be victim of unqualified labels and unqualified trace element content.	FeiHe, LongDan, GaoYuanZhiBao, TaiZiLe and other domestic enterprises.
2016	The milk powder was found to contain Enterobacter sakazakii exceeding legal limits and the total number of colonies was not qualified.	Heshui Guxiang Dairy Co., Ltd., Hulunbeir Obijia Dairy Co., Ltd., Shaanxi Jinniu Dairy Co., Ltd., Ningxia Hongguo Dairy Industry Co., Ltd., Jiabili (Hunan) Food Co., Ltd., Shaanxi Meiliyuan Dairy Co., Ltd., Guangdong Yabais (Shenzhen) Dairy Co., Ltd. and many others.
2017	Enterobacter sakazakii was found exceeding the legal limits.	Hengxin Lejian (Xiamen) Biotechnology Co., Ltd.

Source: WHO, 2008; Qbaobei, 2017.

2008 Melamine Scandal, a turning point after which, various parameters were considered in relation to the BDPs: corporate social responsibility (Zhang & Liao, 2015), corporate governance (Yang & Cao, 2013), clinical profiles of affected children (Wang et al., 2013), buying behaviour (Tong et al., 2015), etc. Those research studies did not, however, fully address the problems in the industry (both private and state-owned) in the context of quality management systems (Burns et al., 2015; Fuller & Beghin, 2015).

Therefore, this research will focus on broader aspects of the incidents in China between 2008 and 2017 which are worth further investigation in the field of quality management and quality management systems. Four Chinese companies and two UK companies were chosen, and interviews with CEOs, directors, quality managers and relevant government officials were undertaken. A separate focus group discussion with the company managers and government officials was delivered. Also, site visits to the Chinese and UK companies were carried out. A comparison of implementing QMS between the Chinese and UK BDP companies will be carried out as follows.

2. Methods—Case Studies

The purposive sampling method was used in selecting companies for the case study, whose participants could provide rich data about the research issues, leading the authors to gain insight and a greater depth of understanding. Four Chinese companies have been selected from three different provinces: Inner Mongolia, Beijing and Shanghai, and they are represented by Companies A, B, C and D for confidentiality. With regard specifically to the sample of companies from China's baby dairy product industry, the market capital of these selected companies is influential as, together, they account for 49 per cent of the market share and are regarded as the most well-known companies in this sector. Two UK companies also have been selected, represented by Companies E and F. Further to this, the access to organisations was also considered while selecting them. Those organisations were selected in which the researcher could have access, in an easier manner. All six organisations provided easy access to their facilities and management teams. Table 2 summarises the general information about those six companies:

3. Results' Analysis and Discussion

Although project management involves pre-production, production and post-production stages, the following aspects within the QMS seem more critical

Table 2. Information on sample case study companies.

Companies	Category	Location	Ownership	Market Capital – in 2015 (billion)
Company A	Liquid milk, milk powder	Inner Mongolia, China	State-owned	CNY 81.67 (*GBP 9.19*)
Company B	Milk powder, milk beverage	Beijing, China	State-owned	CNY 19.6 (*GBP 2.18*)
Company C	Yoghurt, liquid milk, milk powder	Inner Mongolia, China	Private	CNY 71.2 (*GBP 7.94*)
Company D	Milk, milk powder	Shanghai, China	Diversified ownership shareholding	CNY 21.68 (*GBP 2.42*)
Company E	Infant formulas and infant food	Cumbria, UK	Private	Unknown
Company F	Specialised in advanced baby milk formulas	London, UK (headquarter)	Private	Unknown

under the current situation in China after the interview/focus group discussion/site visits were taken. In this research, the focus is maintained on the pre-production stage because it is found to be the most critical for BDP industry based on the interview results.

The findings revealed that different processes and techniques were used by the four companies in order to ensure quality control in the manufacture of their products. A summary of measures for quality control adopted by the Chinese baby dairy product industry is shown in Figure 1.

In response to the interview questions, the companies choose to follow some standards, regulations and laws to meet their own interests (Table 3).

Good Manufacturing Practice (GMP), ISO 9001:2008, quality management certifications, Key Performance Indicators (KPIs), and training and development of employees are some of the basic laws, standards and certifications that

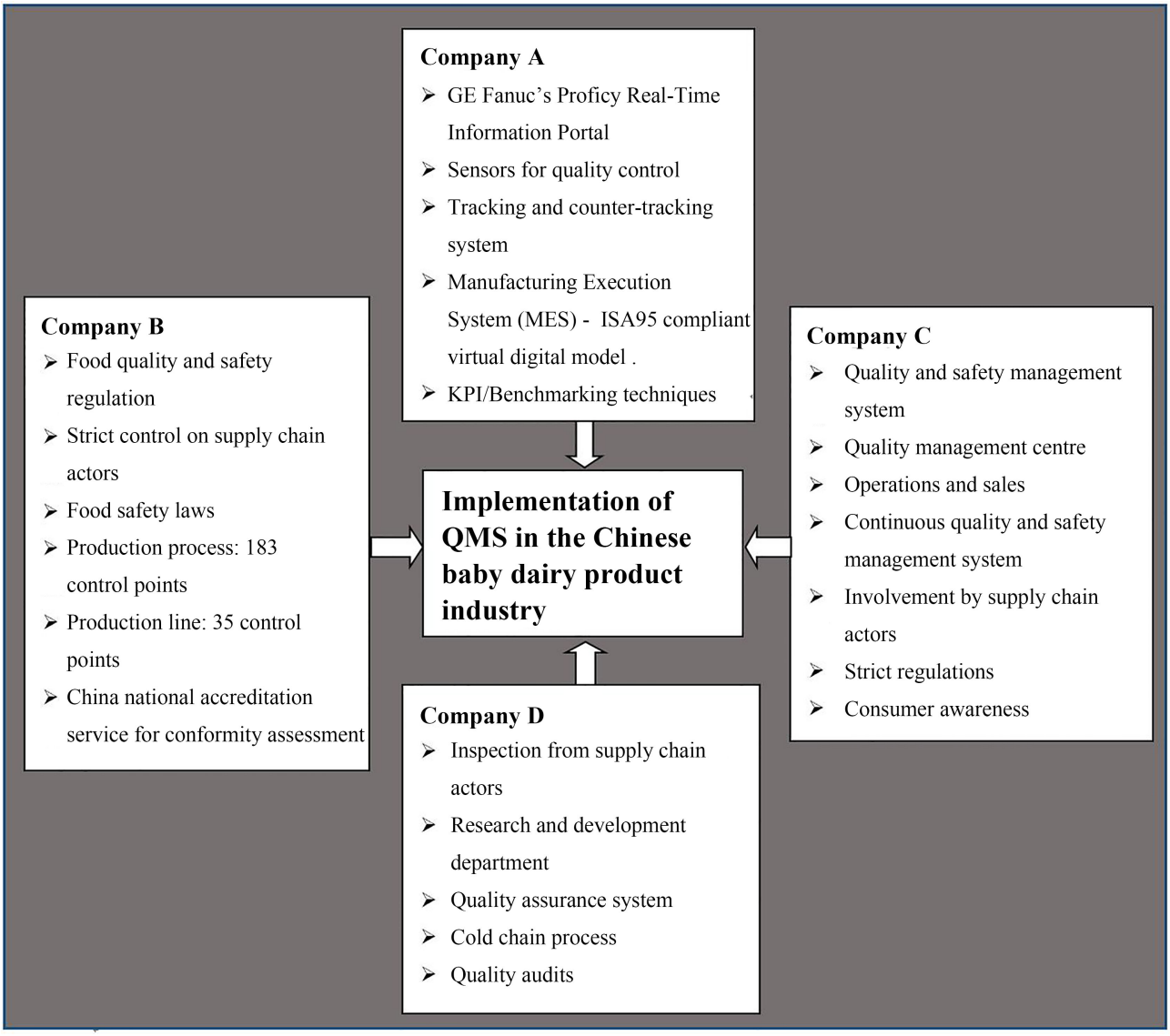

Figure 1. Implementation of QMS in the four Chinese baby dairy product companies.

Table 3. Standards, regulations & laws adopted.

Company	Quality management measures
Company A	• Food safety law • Assured food standards • Quality and safety (quality management certifications)
Company B	• Food safety law • Safe Quality Food programme (SQF)
Company C	• Food safety law • ISO 9001: 2008
Company D	• Food safety law • ISO 9001: 2008

were identified from the interviews. The melamine incident has impacted negatively on the companies' reputations. In order to show that they had a responsible attitude towards quality huge remedial steps needed to be taken. Therefore, each of the selected companies has adopted different standards and regulations of their choice through which quality can be administered. GMP and KPIs are the general techniques they have utilised in order to show that they are seriously committed to quality. Companies consider employees as important vehicles for delivering quality and so invest in training for their staff.

For the purpose of strengthening the implementation of QMS, the practice of benchmarking is also used by the Chinese baby dairy product industry. The findings from interviews' analysis showed that different benchmarks were used by the 4 companies. The term benchmark is used to describe the performance metrics and best practices of other companies that are then used to compare another's business performance in order to identify areas where improvement can be made. One company said they used KPIs as the benchmark; another mentioned the training in QMS given to employees. The cold chain process has been employed as a benchmark in one company and TQM has been used in another. This shows that the selected companies are inclined towards those practices which improve the implementation of QMS. Moreover, benchmarking has helped in institutionalising the quality management interventions made during a company's day to day business.

The focus of the present study is on analysing the implementation of QMS in the Chinese companies. Interviews have found that there are various challenges which are faced by companies when they implement QMS. This section reviews the challenges that are encountered in the baby dairy product industry. The Figure 2 presents the quick overview of these challenges and also clarifies from where the information is coming by specifying the participants. Role of small dairy farms, pre-production factors and use of advanced technology are identified as the most important challenges to implement QMS in China. It has been found that other than all challenges, these three have become the most critical for this industry. So, on the basis of aim of this study which was to analyse the

Participants / Challenges	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3	F1	F2	F3	F4	F5	F6	G1	G2	G3
Role of small dairy farmers	•		•		•		•		•			•			•			•		•	
Animal management		•	•				•			•			•				•			•	
Role of baby dairy product factory a. Internal management and HRM		•			•	•		•		•			•			•			•		
b. Advanced technology	•			•			•			•		•			•		•		•		•
c. Pre-production factors	•	•	•			•		•	•			•			•			•		•	•
Transportation and storage		•				•			•		•					•			•		
Role of government				•			•			•	•			•			•			•	
Quality standards and legislation	•		•	•			•		•			•			•			•			
Incentives				•	•			•						•					•		

Figure 2. Mapping diagram for challenges of implementing QMS in China. Notes: A1 - 3 (Interviewees from company (A); B1 - 3 (Interviewees from company (B); C1 - 3 (Interviewees from company (C); D1 - 3 (Interviewees from company (D); F1 - 6 (Participants from focus group); G1 - 3 (Interviewees from government).

implementation of QMS in China, this research has revealed that these factors are of concern for the managers in the BDP companies.

3.1. Roles of Small Dairy Farmer

In the Chinese BDP industry, there exist a large number of farmers with varying capacities. Those with less than 100 cows are defined as small dairy farmers. Those with 101 - 500 cows are defined as medium sized farmers while the farmers with more than 500 cows are large sized farmers (Nongyezhan, 2020). The demand for BDPs in China could not be fulfilled by a few large multinational companies. Raw milk from the small dairy farmer is also a vital source to the further production in big companies. Inspection on those different sources of raw milk was lacking or non-existent, leading to the raw milk having no quality assurance collectively. The role of small dairy farmers in the BDP industry is critical (Fuller & Beghin, 2015).

After the 2008 Melamine Scandal, China's BDP industry was restructured, and those small dairy farmers who used to add substances to the raw milk would be out of business if they do not follow the newly updated stricter regulations. The reality was that owing to the enhanced regulatory pressures, there was a clear tendency for larger dairy farmers to comply with new standards (Chen, 2009) because they are easier to identify and worked under pressure from the govern-

ment to improve the quality of raw milk. Small farmers tended to pay more attention to quality management, but without technical support and regular checks on their raw milk, little changes were made apart from a positive fact that nobody was found to have added prohibited chemicals to the raw milk.

While in the UK BDP industry, quality is ensured through the involvement of suppliers. BDP companies in the UK source their raw materials only from those suppliers who apply relevant standards (such as GMP and HACCP) and whose raw milk was checked at the point of collection and their information was shared with the other parties involved. Involvement of suppliers at the pre-production stage in QM has proved useful for the BDP industry in the UK, this has been found in the interviews.

3.2. Animal Management

Cows are clearly the foundation of baby dairy products and it is vital to manage them effectively, from birth onwards. Few Chinese BDP companies have a robust system for controlling the cattle on dairy farms they own, and practices on their farm are somewhat remote from the manufacturing facilities and not always appropriately monitored.

By contrast, those UK BDP companies that own their farms have an effective management system for taking care of their cows: from their breeding, feeding, resting, to milking, everything is considered to be important, and every stage is under appropriate monitoring. Therefore, for improving the quality of raw materials and dairy products in the later stages, quality management practices are required from the initial stages of the supply chain with the help of an effective animal management system.

The Chinese BDP industry could improve the monitoring process of its dairy farms through vertical integration of the supply chain where two or more supply chain actors could be combined by one entity. In China, although robotic feeding has been introduced in several companies and the process of milking has become automated, there is still room for improvement. For example, the quality of feed given to the cows needs to be monitored and controlled; grass is not sufficient for cows' need as it has more content of water hence proper fodder is needed for cows. There is a need for proper rules and regulations around the functioning and management of the dairy farms.

3.3. Roles of Baby Dairy Product Factory

3.3.1. Internal Management and Human Resource Management (HRM)

The QMS is managed by the employees, and their attitude and behaviour are of the utmost importance. It was found that the attitude and behaviour of employees posed challenges for the implementation of QMS. Their willingness, commitment and positive attitude are essential for the successful implementation of QMS in the BDP industry. Both the management team and other employees have essential roles to play in the successful implementation of QMS; however, the part played by the management team is the more critical (Evans &

Lindsay, 2002). In China, management remains reluctant to dedicate resources for QMS due to lack of understanding about the importance of quality standards and quality issues, while in the UK, the BDP industry places a high value on HRM and regular staff training is compulsory. However, the Chinese sector does not see HRM as being a critical element in the implementation of QMS, which is problematic.

For managing quality, laws, regulations and standards are the most critical tools. However, one of the internal challenges associated with implementing standards is related to the associated administrative work, where managers must perform efficiently to obtain good results (De Bruyn & Gelders, 1997). Apart from the documentation, the implementation of QMS requires specific skills (such as excellent communication, leadership, planning and management) which need training of both management team members and other employees. Often managers had to undergo extensive training for ensuring that employees have skills and knowledge (Noe et al., 2017).

The successful implementation of QMS requires substantial investment in the training of employees. Also, the application of QMS does not show results in a short period, and managers need to be able to consider things from a long-term perspective (Goetsch & Davis, 2014). This imposed, and is still imposing, a substantial challenge for all Chinese companies who focused primarily on profits.

3.3.2. Advanced Technology

Another challenge is that QMS cannot be implemented effectively without updated machinery and equipment and advanced technology. UK BDP industries use more sophisticated machinery and technology even in the pre-production stage. Every supply chain actor has access to advanced machinery and equipment, which helps companies in the UK to match the quality expectations of the customers.

There is a need for rigorous inspection of milk when it arrives from the dairy farms. The UK industry carries out more inspections than China, enabling quality to be improved as problems can be identified more easily before the products reach consumers. This inspection capability is heavily dependent on advanced technology, notably a traceability system, which could identify all relevant details about the product and relevant supply chain actor. Both the government and the manufacturers contribute to the development of such advanced inspection systems so that quality problems can be traced at the initial stages. In China's baby dairy product industry, it is hard to locate the source of poor quality milk. Neither China's government nor its large manufacturing companies have introduced any similar system for tracing the origin of the milk.

On the other hand, the UK industry is managing its QMS in a better manner because of its information sharing and strong traceability system, which allows it to trace every minor detail associated with the milk to ensure the safety and quality of products (Opara, 2003; Kelepouris et al., 2007; Aung & Chang, 2014). Furthermore, it was revealed that the UK industry uses advanced technology to

measure the somatic cell count, an indicator of milk quality, which was not found in Chinese companies.

3.3.3. Pre-Production Factors

Concerning pre-production, the raw material (milk) should first be inspected for quality problems because prevention of these should start from the source. Microbiological inspection of products is desirable, and this can be done with advanced equipment. However, it cannot be denied that the economic capability of farmers and other supply chain actors in the Chinese BDP industry does not allow them to afford the most advanced equipment. Therefore, the government needs to take a proactive approach towards improving the capability of such small producers so that, in turn, they become able to improve the quality of their products from the very early stage. By adopting a proactive approach, the Chinese government would work for the future development of the BDP industry by developing the capability of farmers instead of helping them by relaxing the regulations.

The procurement of raw materials needs to be thought of as vitally important, and quality inspection processes should start at the dairy farms and continue through all stages of supply, production and distribution. Not only milk is used in the production of baby dairy products, but many other raw materials too, e.g. sugar, protein powder, and vitamins and minerals, and the purchasing of all raw materials requires significant attention. In the UK BDP industry, suppliers are audited on a regular basis (i.e. quarterly). Only those suppliers that are capable of providing quality raw materials are selected. Moreover, UK dairy product manufacturing companies choose those suppliers who have obtained quality certifications. The findings from the four case study companies from China's BDP industry reveal that although they are auditing their raw material suppliers, this is not done regularly enough. It was found that the UK industry has developed a mechanism where suppliers are paid for their products by their level of quality. Consequently, suppliers to the UK BDP industry are motivated to provide quality ingredients to obtain higher prices.

3.4. Transportation and Storage

Chinese case study analysis has highlighted the critical role of third-party logistics services providers in quality management. It has to be ensured that transporters of milk are aware of the quality rules, for example, the required temperature at which milk needs to be stored. It is not possible to deliver good quality milk to customers if cold chain vehicles are not properly maintained. The involvement of logistics companies is a challenge for quality management in China. For keeping the desired level of quality during transportation, the importance of controlling temperature increases. Hence, BDP companies need to keep an eye on the operation of logistics companies, and this could be done through vertical and backward integration of the supply chain, often resulting in high costs for companies. If a baby dairy manufacturing company decides to carry out its own transport, then it needs to ensure that drivers have the necessary know-

ledge and skills to be able to transfer the milk quickly and safely.

Warehouses are also part of the supply chain of the BDP industry. When there is insufficient capacity to transfer milk immediately to its destination, it has to be stored in warehouses. To have sufficient ability for stocking milk is another challenge for BDP companies. Milk must be stored at the correct constant temperature. Unfortunately, overstocking in the warehouse can cause the temperature to fluctuate, leading to quality problems arising (Marisa et al., 2002; Alvarez, 2008). While Chinese BDP companies are striving to improve QMS about warehouse storage, the UK companies have already addressed this problem successfully. UK companies are able to manage the quality better due to their information traceability system which helps them to keep a track record of performance of its involved parties. So even if products are out from its production house and are at warehouse, it still continues monitoring its quality which helps become successful in managing quality issues.

3.5. Roles of Government

The Chinese government is not currently playing its expected role in the implementation of QMS in the BDP industry. There is, therefore, a need for more emphasis on the enforcement of quality regulations in China and a need for appropriate management and supervision by the relevant government departments. The application of QMS in the BDP industry could be improved by clearly defining their roles, responsibilities and accountability of the Ministry of Agriculture, the Ministry of Water Resources, the State Bureau of Quality and Technical Supervision, State Administration for Industry and Commerce, the Ministry of Industry and Information Technology and the Ministry of Environmental Protection.

Although numerous laws, regulations and standards relating to quality management do exist, the government has not been sufficiently strict regarding their implementation. Also, government departments have their own specific goals and objectives, but there are overlaps and inconsistency in their roles, so responsibility for particular tasks is not always clear. Some of the necessary elements in improving QMS for the Chinese BDP industry (e.g. information sharing) have still not been assigned to any government department. The analysis shows that without clear lines of responsibility, it is not known who is responsible for what and who should be taking appropriate measures for solving the quality problems. Due to the bureaucratic system in China, the melamine incident was a result of the ineffective role played by the government. Interviewees did, however, report certain improvements, for example, the new Food Safety Law has been officially promulgated now.

3.6. Quality Standards and Legislation

Consumers are now not only concerned with a product's features but also its quality and safety. Buying any type of food is a decision heavily dependent on quality and safety (Anić et al., 2014). When quality standards are not imple-

mented, companies often have to face severe consequences (Arvanitoyannis et al., 2016). Quality standards and legislation allow companies to introduce a process of continuous improvement, hence their competitiveness increases. The analysis of the UK BDP industry has shown that both UK companies studied have been able to improve the quality of their products by applying quality management standards. These days, companies cannot overlook implementing legislation and rules because they allow companies to improve their competitiveness in the international market as well as produce products that comply with international standards. With the adoption of various quality standards, such as the BRC food safety standard, ISO 9001, ISO 14001, Kosher, Halal and Soil Association certification, and GMP, the UK companies have been able to improve their competitiveness in the international market.

Chinese BDP manufacturers need to adhere to quality standards if they are to meet customer demand. China's rules about quality management are not very rigorous and this is due to the local situation. Chinese government knows that very strict and rigorous laws might not be appropriate as per capabilities of local farmers and they might be out of the industry otherwise. After continued problems as listed in **Table 1**, the country is gradually progressing by adapting international standards to its circumstances.

Many farmers possessing fewer than five cows, however, are not in a position to comply with strict laws, regulations and standards (Sharma & Rou, 2014; Psomas & Kafetzopoulos, 2015). The Chinese government is aware of this situation and, therefore, its current rules are relaxed because, if they were not, it would have a devastating impact on the baby dairy industry in general. Small milk companies would be put out of business in a situation where the current consumption of dairy products is already increasing. As a result, the self-sufficiency of China's baby dairy industry would be adversely affected. The challenge for the government is to ensure that it designs standards at a level which would promote quality throughout. It can be observed that the UK government has introduced strict rules for its BDP industry. UK government also provides aids to its farmers to manage quality and implement quality management system. Therefore, as far as China is concerned, there is a need for change at the system level and the government of China will have to have a significant role in this broader level change.

The analysis has found that China's national standards are unable to prevent small milk companies adding harmful substances to milk, which is a significant challenge for this industry.

However, after the melamine incident, efforts are being made around improving the legislation that applies to the Chinese BDP industry. The content of international standards has been adopted by the Chinese industry, but in a customised format to suit the local situation in China. There are specific weaknesses in China's rules, e.g. they do not specify the quality level for many ingredients in food products. Most importantly, it was found that penalties for non-compliance were insufficient.

Following the melamine incident, several of the regulatory authorities of China now understand the importance of quality and are taking their roles seriously (DeLuca, 2016). They are trying to keep a check on the processes and products of BDP companies and, to this end, carry out quality inspections, testing sample products from the industry in a random manner to ensure that the desired level of quality has been achieved. This measure is a favourable development in the practices of the Chinese regulatory authorities. Comparing this with what happens in the UK BDP industry—the regular inspections carried out there by the Food Standards Agency—it could be said that this practice should prove helpful for increasing the quality of BDPs in China, as it already has in the UK.

3.7. Incentives

Incentives are important to be provided to the involved supply chain actors. In the Chinese dairy product industry, there is not any focus on offering any incentives to stakeholders. Farmers know well that if they will be ensuring quality of the milk, they will have to apply more effort and resources but they will not be provided with any extra benefit. The companies which purchase from these farmers also do not focus on providing the incentives. Interview results have showed that the Chinese government bodies have also not considered this aspect ever where farmers, intermediate parties, transporters and distributors could be provided with extra benefits for their extra efforts. Now Chinese government is working more on the enforcement of regulations, however, it is still not something which will positively reinforce following the quality standards. In the UK, things are a little different where there are subsidies such as financial aid or price reductions which are provided to those farmers who are willing to provide quality milk. It has been realised by the government that they are not having adequate resources to ensure the quality, so government gives subsidies to farmers which enables them and motivates them to follow the quality standards. When BDP companies get milk from smaller farmers they also prefer those farmers which are having quality fulfilment practices. They are even also willing to make higher payments to those farmers which follow the quality standards. In this way, farmers have obtained incentives to follow the quality standards. The selection process for supply chain practices is also on quality management practices. When the final contract is made, this is offered to those supply chain actors who are following the quality standards. If anyone has the ISO certification, their chances of selection increase further. Easy terms and conditions are set for those suppliers who have ISO certification or who can provide assurance that they will provide quality work. In this way, all supply chain actors do have the motivation to follow the quality standards.

3.8. Summary of the Comparisons

A summary of the comparisons between QMS in the Chinese and UK BDP industries is given in **Table 4**.

Table 4. Comparison of the Chinese and UK BDP industries.

Items	China	UK	Comments
Emphasis on HRM	-	✓	HRM is considered important in the UK companies while China's companies have not emphasised on this aspect for managing the quality of BDPs.
Investment in training of employees	✓	✓	The level of investment is more significant for the UK.
Use of advanced technology	✓	✓	The UK has more advanced technology.
Quality inspections	✓	✓	A higher number of inspections are carried out, and the process is more rigorous in the UK.
Traceability system	-	✓	UK dairy industry has developed a strong traceability system.
Information sharing	-	✓	In UK dairy companies, there is extensive information sharing among supply chain actors.
Animal management system	✓	✓	The animal management system in the UK is better planned.
Robotic feeding systems	✓	✓	Both countries are using these in a similar manner. However, small milk producers in China are unable to adopt such systems.
Internal rules and regulations for dairy farm management	✓	✓	The UK's management system is more advanced.
Emphasis on source	✓	✓	Both have realised that source is vitally important.
The rigorous selection process for suppliers	-	✓	In the UK, suppliers are selected by quality certifications.
Regular inspections and audits on suppliers	-	✓	In the UK companies, inspections and audits for suppliers are organised on a regular basis.
Involvement of suppliers in quality management	-	✓	In the UK, suppliers are provided with the incentive of higher prices for their milk depending on its quality. Though not all companies from UK BDP industry can manage the suppliers, practices for their involvement are observed.
Inspections at each stage of production	✓	✓	Both industries use quality inspection tests conducted by their internal quality assurance/control/inspection departments.
Strict manufacturing guidelines	-	✓	The UK baby dairy companies are following the strict manufacturing guidelines, and this helps them to prevent quality problems.
Inspection of each final product	-	✓	Using advanced technology, UK companies test every single final product. On the other hand, China's companies are taking from a final batch of products as sample and inspected for quality.
The sophisticated and effective packaging system	✓	-	China has adopted sophisticated and effective techniques for packaging.
Involvement of third parties in QMS	✓	✓	The UK has a more organised system for involving third parties in QMS.
Skilled drivers and suitable transport	✓	✓	Both have realised the importance of using skilled drivers and suitable, temperature-controlled transport.
QMS in the warehouse	✓	✓	Chinese companies have realised that they need to give attention to this aspect and are aware that improvements need to be made.
Use of technology at the post-production stage	✓	✓	Both are using this, but the UK has more advanced technology.

Continued

Supportive and active role played by government	-	✓	The government of UK is playing a supportive role in supporting the quality management at BDP industry.
National quality standards	✓	✓	The UK has stricter standards which result in better quality and fewer problems for the industry.
Robust implementation of legislation	-	✓	The system for enforcing the legislation related to quality management is quite robust in the UK.
Internal quality standards	✓	✓	The industries in both countries have internal quality standards that help them to manage quality.
International quality standards	✓	✓	The industries in both countries have adopted the international quality standards. However, China is far behind the UK in the process.
Incentives	-	✓	UK industry provides the incentives to all supply chain actors to implement quality management system while Chinese baby dairy industry is not doing anything like this.

4. Summary

From analysing the quality management systems in Chinese and UK BDP industries in the pre-product stage, one can conclude that, in China, many aspects of QMS, e.g. animal management, implementation of quality standards and HRM, are not handled well, and it is vitally essential for quality and safety issues to be managed in a proper manner. From the analysis of this research, it has been found that the companies which control the whole supply and production process from the raw milk through to the end product are in a much better position to prevent uncompromising quality and safety problems. The UK BDP industry is already managing quality by implementing QMS throughout the whole process. To gain and retain the trust and confidence of consumers in China, an improved system is needed whereby all supply chain actors in the BDP industry are equally important to contribute to QMS. It is important to note that all supply chain actors, such as, dairy farmers, supply chain actors, baby dairy product companies and the government need to participate in information sharing, the core of which would be the introduction of a traceability system, because this has the potential to solve many of the problems the Chinese baby dairy product industry is facing. The government should also take a proactive role and bring about changes in its roles and responsibilities. To a certain extent, the Chinese government is playing a crucial role, and consolidation of dairy farms into large-scale milk production units along with sourcing milk from large dairy farms are being promoted. In response to this, many Chinese companies have adopted the vertical integration of the supply chain. Previously, it was quite dispersed but now has become quite standardised and concentrated. However, there is still room for improvement as this practice has been adopted by only a few companies and there are still many others that are unable to ensure this integration. Finally, it must be observed that if QMS is to be implemented successfully in the industry, all stakeholders must be involved. All parties should

work collaboratively to ensure implementation of and compliance with the relevant laws, regulations and standards.

Limitations and Future Research Directions

This research faced certain limitations which cannot be ignored and are worth further investigation. The first limitation is that the research was focused only on the pre-production stage of BDP manufacturing process. The other two stages (i.e. production and post-production stages) are also the same important as the pre-production stage to deliver satisfactory final products. The second one is that this research was restricted to the Chinese BDP industries and its findings cannot be generalised to other Chinese industries. The third one is that the research was focused in China and the comparison was made between China and UK. The countries' cultures, traditions, development and economic scales are all behind those results although they are not specifically mentioned. The research results should be justified if they are used in different situations.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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