

Northumbria Research Link

Shokri, A., Nabhani, F. and Hodgson, S. (2009) 'Supplier development practice: Arising the problems of upstream delivery for a food distribution SME in the UK', Robotics and Computer-Integrated Manufacturing, 26 (6), pp. 639-646.

This paper was originally published by Elsevier, 2009. Further details are available on the publisher's Website:

<http://www.elsevier.com/>

The original publication can be accessed, with permissions, from the following link:

<http://dx.doi.org/10.1016/j.rcim.2010.06.028>

University Library, Sandyford Road, Newcastle-upon-Tyne, NE1 8ST

Supplier Development Practice: Arising the problems of upstream delivery for a Food Distribution SME in the UK

ABSTRACT

The paper aims to emphasize on impacts of the supplier development on reducing the defects in supplier quality for a food distribution Small – Medium sized Enterprise (SME). An empirical study was conducted to measure the performance of the suppliers in three different key performance indicators of the outsourcing and supplier's performance to arise the existing problems via information exchange, data collection and data analysis. It was found that Supplier development through data and information exchange and better communication by any food distribution SME raises the problems more promptly. This can dramatically change the supplier's behavior to improve the quality of the supplier's service and products. It is suggested that more research is required to raise other key performance indicators and their related problems and to develop more improvement practices. Six Sigma Methodologies could be the potential good practices to be focused in future research studies. Supplier performance measurement, which encompasses data exchange and data collection, develops the systematic flow of information which potentially improves the flow of goods and the whole food supply chain to address the final consumer satisfaction. The research took a novel approach in adopting some transport related key performance indicators of the food supply to the Food distribution and retailing sector which is almost a new approach in food industry.

Key Words – Supply Chain Management, Small to Medium sized Enterprises, Supplier Development, Food Distribution

1. Introduction

Supply Chain Management (SCM) has always been a key element of a successful and competitive business. It consists of managing different levels of internal or external organizational transactions which generally represent the flow of goods and flow of information. There have been different understandings of SCM most of which reflect the need for the customer development and logistics. Arguably, in its most advanced form, SCM is not a subset of logistics but is a broad strategy which cuts across business processes both within the firm and through the channels required to reach the customer and involves the firm's suppliers[1]. It appears that supplier development alongside the customer development builds the structure of Supply Chain Management. There have been different studies which indicate the proper management of supplier relationships constitutes one essential element on supply chain success [1-4]. The literature has emphasized greater collaboration between the firms and their suppliers to assure an efficient and successful supply chain [5].

Over the last decade, researchers have empirically investigated a variety of research issues that are related to supplier development activities. These issues include critical factors of supplier development [6,7]; the process of supplier development [8-10]; the factors that influence buying firm's involvement in developing their suppliers[11]; and the effect of technical support provided to suppliers on the performance of both suppliers [12,13] and buyers [14]. Supplier development, as an important construction block of the supply chain, has been adopted in this study to evaluate its effectiveness in a tailored industry with a variety of supply concerns.

This paper intends to focus on supplier development in order to investigate the effect of a systematic quality improvement strategy on improving the supplier's efficiency and supplier service quality in a food chain. One of the most common characteristics of the food chain is meeting the customer's requirement, which is challenging. This has been addressed in some literature [8-10] in which supplier development has been introduced as the effective way that improves supplier's capabilities to meet buyer's requirement. The most useful elements of supplier development which potentially can improve the supplier's service quality are examined in this paper.

2. Supplier Development

Supplier Development was pioneered in the automotive industry such as Toyota and Honda which are the masters at supplier development initiatives [15]. The relationship of supplier development practices with performance has been addressed in several studies [3, 14, 16].

The concept of supplier development has received considerable attention from researchers [3, 1, 17, 20]. The obvious understanding of supplier development from these studies is the different approaches to defining supplier development.

Wagner (2006) [19] defined supplier development as supporting the supplier in enhancing the performance of their products and services or improving the supplier's capabilities [19]. Many researchers determined supplier development as an activity which encompasses a long term cooperative effort by buyer firm with its supplier to increase the performance efficiency and/or capabilities of the supplier [6,19,21].

Supplier development is considered as improving the flow of information from the buyer in order to upgrade the suppliers of different tiers. More over, many studies [4] considered supplier development as the assisting activities to improve supplier's operations. These activities involved:

- Supplier evaluation [14,18]
- Award Certification [14,22]
- Providing training and technical assistance [22,23]
- Establishing effective communication between parties [22,24,25,26]

There are also some other researchers that defined supplier development through different dimensions. For instance, supplier development has been considered as the purchasing management or procurement [3,27], and it has also been defined as the local supplying in which the number of suppliers are rationalized or/and reduced to the minimum in order to establish the longer – lasting relationship with the supplier [3]. The latter definition is focusing on relationship management and building a trust based relationship with more reputable suppliers, while the former definition of Fung(1999) and Cristobal(2005) covers every individual activity which can improve supplier's operation [3,27].

The buyers have a more discerning view of their purchasing relationship in order to make sure that their supplier adds value to the product and the service that they provide. Likewise, the supplier not only must provide a good quality product, but is liable to deliver a service quality which will add value to the product. Service provision is also part of an effective supply chain alongside the flow of material from the supplier. De Toni (1994) suggested that the suppliers must show the adequate amount of technological knowledge/ability and the capacity to take care of R & D and design activities [28]. Therefore, the supply chain network needs to be capable of information exchange and communication between customer and supplier. This critical issue has urged more researchers to examine different approaches and elements of supplier development. Supplier development divisions according to its application, context and structure have different approaches from a variety of researchers. Cristobal (2005) categorised supplier development in terms of its application and practices including basic, moderate and advanced supplier development [3]. The result of his study is consistent with some other researchers in this case [14,29] to promote the idea of complementary effect of these three approaches on performance. The application of these approaches depends on the resources of the buyer and level of relationship between the buyer and supplier. The buyer with limited resources is more prepared to apply basic supplier development practices including supplier evaluation, feedback, supplier selection and supplier awarding [3]

Lo (2006) has analysed supplier development through the buyer's involvement in supplier's activities. Lo (2006) has indicated that supplier development can be applied both directly and indirectly by the buyer [4]. Direct involvement including awareness of supplier quality, reporting quality problems, evaluating supplier performance and providing feedback and technical assistance is a more effective component in supplier development [4,19]. Indirect supplier development activities including evaluation and communication are closely linked to direct supplier development and could be regarded as the enabler of direct supplier development [14,30,31].

Krause et al (1998, 2000) has also indicated supplier development in two different efforts. The first effort is the reactive approach in which the measures are indicated in case of existing poor supplier capability. The second effort is a proactive or strategic approach in which supplier's performance is improved actively and for the long term, before problems happen [4]. It appears that the latter effort is more challenging, but more effective, since it needs a trust orientated relationship, more supplier's commitment and more buyers' resources. The mutual benefits of supplier development in both supplier and buyer have been acknowledged in many literature sources [7,32,33]. The improved supplier's operation is the most common benefit of supplier development which results in improved product and service to the customer and transmitting the value added product and service to the downstream. This

will increase the efficiency of the supply chain. Cannon and Perreault (1999) and Nourdewier et al (1990) have indicated supplier development as the strategically important block to build a strong supplier management structure [19,34,35].

2.1. Benefits of Supplier Development:

Cristobal (2005) and Krause et al (1997b) have focused more on the effect of supplier development on improved operation as the result of supplier development [3][7]. Krause et al (1997b) has suggested through a case study that supplier development could result in a 79% reduction in the number of product defects and a 14% increase in on-time delivery [7]. Supplier development can also potentially be beneficial to the buyer's firm. As companies search for new opportunities to reduce costs and improve operational efficiency, relationships with their supply base have become a key asset in improving profitability [33].

Wafa (1996) has evaluated the effect of supplier development on JIT through analyzing different hypothesis about the impacts of some supplier development elements on the success of JIT. He concluded that all supplier development elements unanimously have positive correlation with JIT success [32]. Some other literatures directly pinpointed cost reduction for both supplier and buyer via reducing waste (rework and recall), time and paperwork as the result of supplier development practices [21,36,37].

2.2. Elements and Practices of Supplier Development:

Supplier Development practices are the forming elements of building a strong supply management which have been determined as the key successful factors of the supplier development by many literatures [3,4,27]. The key component of effective supplier development is strategic information sharing and long term relationship. The dominant attributes in supplier integration include mutually sharing strategic information and benefit [24,25,38] and establishing long – term buyer – supplier relationship [25,26,38] and mutual trust [24,26]. The level of buyer's involvement in supplier development practices is an important issue which can categorize the activities in different approaches. Basic supplier development activities include supplier evaluation, supplier selection and supplier awarding [3]. These activities can be practiced either direct or indirect. The level of communication and information sharing could also be different. The literature suggested that the basic communications include the face-to-face meetings, E-mail and Fax, while the advanced communication methods could be Enterprise Resource Planning (ERP) or Electronic Data Interchange (EDI). The use of communication methods broaden and deepen accessible information about business activity and facilitates user participation in a variety of information networks [10,39,41]. The empirical research results also showed that effective information sharing in a timely manner and frequently with supplier is a big step to establish supplier development [10,42].

Different learning activities through mutual information exchange have radical impacts on supplier development efficiency [5]. The learning activities are either single or double loop in which the former is achieved by training methods but the latter is more elusive as it is more challenging to the existing process. [43,44]. It is understood that these elements regardless they are approached direct and indirect or basic and advanced are the key successful factors for an effective supplier development practice. They are required to be adopted adequately and in a mutually trusted environment between supplier and buyer. The communication method is the base of other practices, since the basic communication can affect the profile of information sharing. The activities can also be adopted through a sequential process to have more effective results. For instance, the buyer can evaluate supplier performance, provide feedback, train the supplier and support the supplier to maintain the changes to the operation in accordance to method of communication.

This paper aims to review the problems of supply base within a food distribution SME through identification of key issues, measuring the existing process, finding the root causes of the problem followed by a problem solving case study.

3. Industry Overview

The food service quality supply is the centre of attention in this study. A UK based food distribution with more than £5M annual turnover supplying the food outlets has been selected as a case study, because it meets the features of typical food service SME involving in purchasing management, warehousing, delivery, transport and sales management. The company operates in a tense competitive market and is required not only to meet customer requirements but also to delight the customer by providing the best service and quality product in order to be

sustainable in the market. This company is not a manufacturer and its operation is purely providing quality service to the customer with minimum defects. Hence, it is inevitable to transfer the market requirement to the upstream in order to receive the right quality of the service and product. Supplier development could be a promising strategy to establish the value added service and quality in the chain. The company's suppliers are either UK or EU based and include the distributors, trading companies, manufacturers and wholesalers.

The base of food and packaging supply met the 80/20 rule, while the 80% of the products were supplied by 20% of the suppliers. The key supplier with more than 50% of supply base was a trading company using the outsourcing. Some other national and international suppliers have also been using the outsourcing in order to deliver the goods to the depot. This had made some complex networks where the company had to communicate with the first tier supplier in order to report the problems about the quality of the product or delivery and await for the response from second tier supplier or manufacturer or outsourcing company via the first tier supplier. Figure 1 represents how the communication between the company as the buyer and the supplier is happening in this market. The figure depicts that the both flow of information and flow of goods are happened directly with the next tier supplier.

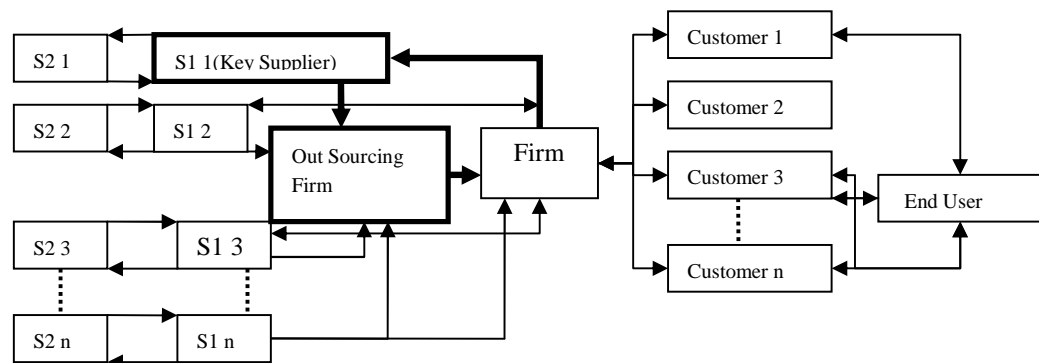


Figure 1 – The supplier and customer networking system in this food supply chain

Figure 1 illustrates that S11 as the key supplier received the order information directly, but delivery of the goods is through outsourcing firm. Some other suppliers have also been using outsourcing firms to deliver the goods, although the flow of information from the buyer is communicated direct to the supplier base. Outsourcing features and problems are also key performance indicator (KPI) in problem solving. Outsourcing or third party logistics is generally defined as the provision of a single or multiple logistics services by a vender on a contractual basis and it has two elements including transport and storage [45]. Exchange of information and measuring the performance of the logistics operation are the key performance indicators for outsourcing [45,46]. Many organisations use outsourcing to maintain their position in market and increase the ability of expanding the market share. Improving of the service, increasing in operational flexibility and reducing the cost could be the possible benefits of outsourcing [45].

The key performance indicators of the supplier development have been selected in order to raise the major problems or defects in supply base. This information was collected via long term operational observation. Delivery condition, on time delivery and product quality were selected KPIs in the selected organization. The associate problems with these key factors were also indicated. Despite of some manufacturing originated problems, sources of the most of problems were logistics and outsourcing. It is pretty important to note that all of the goods were delivered either by the manufacturer owned transport or outsourcing. Moreover, many of goods were stored in the outsourcing storages for a while and this may have dramatic effect on the original quality of the goods. It means, the goods might meet the standards of quality at the point of leaving from manufacturer, but the quality might drop through transport or outsourcing while the goods are in the hand of trading company which requires outsourcing facilities. These supplier associated problems are examined more deeply in the company through this study in order to measure the performance of the supplier and outsourcing.

3.1.-Problem 1- There is a poor “Booking In” System by the suppliers:

“Booking In” system is a standard procedure for suppliers in Supply Chain to save the time and effort in transportation of the goods. The company has established the “booking in” system through which, the date and time of delivery by suppliers or outsourcing firms are being recorded. This will help the shop floor team to preplan for the

delivery which will result in more streamline operations and faster offloading. The existing “Booking In” system was not effective, since most of the suppliers or third party logistics do not comply with that. The operation of this system was monitored for 13 weeks and the records were analysed in order to assess the supplier performance.

Table 1 – Condition of the upstream in Booking In and Delivery On – Time

	Count
Total upstream Deliveries	480
Booked Deliveries	126
In which on time arrival (+/- 30min)	58
Booked Delivery %	26%
On time arrival %	12%

The data analysis revealed that the majority of upstream organizations in this supply chain failed to provide quality service to the company. This analysis was carried out as the part of supplier evaluation which is an important basic element of the supplier development. Table1 represents that only quarter of the supply deliveries have been booked in which just 12% were delivered on-time.

3.2. Problem 2 - The supplied products are not meeting the quality standard:

The condition of delivery and the quality of delivered goods are two dimensions of the service quality. If the quality of products doesn't meet the standards, the service quality provided by the supplier will fail. The failure of service quality can have dramatic impacts on business performance, cost, customer satisfaction and profitability of the supplier [47].

The company decided to review the supplier's performance to assess whether the delivered goods met the quality standards. The deliveries of the suppliers were closely monitored for 24 weeks and the defects were recorded prior to a pilot study. This study identified the number of quality defects associated with supplier's performance, exposed the potential cause of defects and suggested the action taken by the buyer. The total numbers of 26 supply based defects were recorded for 24 weeks. Every individual defect was treated separately. The result of study is presented by table 2.

Table 2 – The actual supplier's defects, sources and actions for the Food Distribution organization

Defect	Numbers	Possible source	Taken action			
			Reject	Recall	Receive	Report
Poor pallet layout in Wagon	4	Logistics	1		3	3
Broken Pallets	3	Logistics			3	3
Crushed Packaging	7	Logistics	2	2	3	6
Poor Wrapping	7	Manufacturing			7	7
Contamination	2	Manufacturing		2		2
Poor Storage & Handling	2	Manufacturing, Logistics		2		2
Poor Labeling	1	Manufacturing			1	1
Total	26		3	6	17	24

This study was conducted to review the key supply problems and assess the buyer's performance to take action against each individual problem. The study revealed that the company has received the goods in 17 occasions, arranged with the supplier to recall the product in 6 occasions and 3 deliveries were rejected immediately in delivery point. Moreover, the firm as the buyer had effective communication with the supplier through reporting the non-conformances to the supplier, never-the-less; many of the deliveries were received by the buyer. The company was facing with different quality related customer complaints which must be reported to the supplier. There was a recording system available in the company to record, report and monitor the quality related complaints to the supplier. This record was reviewed and the results are presented in table 3. The difference of these data with the table 2 is the source of complaint. The source of the data in table 3 was the customer, whilst the source of the data in table 2 was the company's quality assessment team.

Table 3 represents 67% of the recorded quality related customer complaints were sourced in supply base. The rest 33% was either unknown or unwanted. Therefore, they could not be classified as the quality related complaints. This part of study revealed that 61% of the supplier related complaints are recalled and reported to the supplier. This indicates that this organization has built an information sharing system with the suppliers in this specific aspect. The complaints have been reported through basic communication methods such as E-Mail, telephone, fax and face to face visits.

Table 3 – The quality related complaints and the proportion of supplier associated problems

	Count	Percentage
Total Numbers of Customer Complaints	108	
In which Supplier associated complaints	72	67%
In which the product has been recalled and reported to the supplier	44	61%

Having identified the key problems, the paper reviewed one of the major problems in its upstream involving one of its 1st tier and 2nd tier suppliers followed by a systematic problem solving procedure to minimize the defects and improve supplier's performance. It is intended to highlight the company's role as the buyer in the process of supplier development.

4. Taking corrective action – A pilot case study in Supplier Development

4.1. Purchasing Process Overview:

One of the key products that the company sells is the “Corrugated Pizza Boxes”. This product is bought from the key supplier of this company which is a UK based trading company. It means the supplier takes the order and transfers it to the main manufacturer which is based in the Middle East. The manufacturing firm had no UK market and there was no vision of this market to indicate the UK market standards. So, the quality was not matching with the UK standards. The manufacturing firm produces and loads the Pizza Boxes in the freight containers. Then the product is shipped to the UK market and delivered to this company by the third party logistics. Therefore, there is at least 90 days lead time for this type of delivery. The flow of information including the order sheets, Invoicing and the packing list is conducted through the 1st tier supplier, whilst the goods are delivered direct to the company.

4.2. Problem Overview

The delivered pizza boxes have not met the buyer's satisfaction due to quality related problems. There was no direct communication with the 2nd tier supplier as the manufacturer used to speak out the problems. The management team decided to take action to reduce the cost of poor quality which are as the following:

- Rejected products
- Reworking
- Inventory and space
- Potential customer loss

Figures 2 and 3 represent the examples of the problems with the imported Pizza Boxes. Figure 2 depicts a broken Pallet which was received on the delivery point. This could happen during the lengthy transport or storage and loading process. Figure 3 also depicts the poor outsider packaging or poor pallet wrapping which was observed during the offloading. This could result in potential damages to the actual product. It is important to note that these problems were common failure measures by the manufacturer which needed to be assessed promptly.

As first step, the management team decided to reflect these problems to the manufacturer through the 1st tier supplier. The information was sent to the 1st tier supplier and a high profile meeting was conducted with both suppliers. A steering committee has been established including the management team of the distribution company and the 1st and 2nd tier suppliers to tackle this problem. Then, it was decided that the quality control team in the distribution company to observe, record and measure the data of products quality at delivery point and provide the information to the 1st tier supplier. In fact, this was a huge step in supplier development, since all three parties were

closely involved in communication and sharing information. It was also agreed that e-mail, fax and telephone are the best way of communication, as the manufacturing base was in the Middle East and regular close meeting was unlikely to happen.



Figure 2- Broken Pallet of Pizza Boxes in Delivery Point



Figure 3 – Poor Pallet Wrapping in Delivery Point

The quality management team started to monitor the inward containers of the “Pizza Boxes” and record the issues. The measuring criteria for the condition of different areas of product delivery were set up in order to inform the manufacturer about their existing operation. Table 4 represents the quality criteria for different areas which were closely assessed by the quality management team. In fact, this set of criteria would help the manufacturing firm to benchmark their performance and reduce the number of defects. The quality control team assessed the condition of four inward containers coming from the middle-east manufacturer against the measuring criteria. The simple and understandable set of data and quality ranking for each area of the delivery alongside the useful pictures of the defects were provided to the manufacturer firm.

Table 4- The measuring criteria for the quality of different areas in inward delivery of containers of the Pizza Boxes

	Very Good	Good	Average	Poor	Very Poor
Pallet Condition	Impressive	No poor quality	≤ 10% Poor quality	10 % - 30% Poor	≥ 30% Poor quality
Wrapping of the Pallet	Impressive tight and Multi layered Wrap	No loose, damaged or poor wrap	≤ 10% loose, damaged or poor wrap	10% - 30% loose, damaged or poor wrap	≥ 30% loose, damaged or poor wrap
Stacking Condition	Strong, straight & Top level stacking	No poor or leaning Stacking	≤ 10% poor or leaning Stacking	10% - 30% poor or leaning stacking	≥ 30% poor or leaning stacking
Packaging	Tight, Strong & Perfect Packs	Not tight but No obvious damages or holes on packs	Not tight and very few obvious damages or holes on packs	Not tight and few obvious damages or holes on packs	Not tight and many obvious damages or holes on packs
Product Quality	Perfect & Impressive quality in every issue	Less than 5 obvious damages on the Pizza Boxes	5- 10 cases obvious damages to discarded the products	Few uncommon obvious damages to discard the products	Too many uncommon obvious damages to discard the products

The results of the whole assessment are presented in table 5. It was concluded that the quality aspects were mostly less than average, since many of the aspects were poor. Generally, the condition of the delivery of the Pizza Boxes was not satisfactory, since the condition of 50% “goods in” containers was poor. Figure 4 illustrates the general condition of these containers which exposed the unsatisfactory feedbacks from the food distribution in the position of buyer. As a result, the whole supply chain would be affected by the poor quality of the delivery.

Table 5- Condition of different areas of Inward containers before modification

	Very Good	Good	Average	Poor	Very Poor
Pallet Condition			50%	50%	
Wrapping			25%	50%	25%
Stacking		25%		75%	
Packaging			25%	75%	
Product Quality		75%	25%		

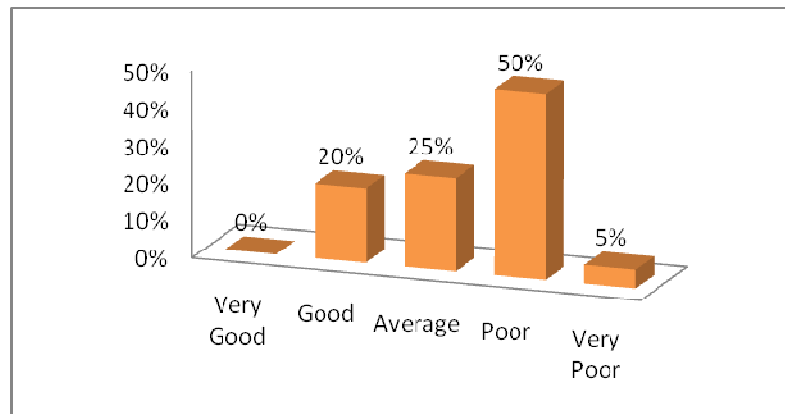


Figure 4- General condition of "inward" containers of the Pizza Boxes before modification

The quality assurance department of the manufacturing firm has decided to look more carefully on the areas where more modification is required. The measuring criteria and the existing performance of the manufacturer were set to enable them to find the root causes of the defect. It was acknowledged by the manufacturer that no other buyers provided such information to help them to improve their performance.

4.3. Taking action Process:

Having analysed the useful information and comments provided by a 2nd tier customer, the manufacturer's top management team decided to modify their operation to meet the UK market standards which was originally higher than their expectation. The root causes of these defects were identified and the set of following actions was established in production and packaging line to minimize the level of defects:

1. Stricter control all through the production process from the corrugating section to die cutting.
2. Applying two straps to the bundle instead of one.
3. Special supervision at the angel hair removal process.
4. Special supervision at the shrink tunnel process for the bundles.
5. Flat stacking of bundles on pallets. No more stacking on bundle edges.
6. Pallet strapping from four sides.
7. Better protected pallet corners.
8. Strict control on in-house forklift drivers (pallet handling) at, production and warehouse / shipping ends.

Apparently, the action number five would affect negatively on the number of items on each pallet and therefore affect on cost efficiency of manufacturer. In order to reduce the problem, it was decided to use different pallet size standards rather than one single pallet size standard. Having implemented these actions on the production and packaging lines, the condition of the delivered freight containers of the Pizza Boxes was analysed for next four inward containers and the result shown in table 5 indicates the significant improvement on the condition of the delivery. The general quality of the condition of each "inward" container has improved and it indicates that the manufacturer firm is achieving to the UK market standard by providing satisfactory delivery to the buyer. Arguably, the root of the problems was identified in production and packaging lines. Therefore, the third party logistics

(outsourcing) had little or no effect on the quality of delivery, never the less, the container was in shipment for more than 3 months. Figure 5 illustrates the general condition of delivery after developing the supplier through information exchange.

Table 6- Condition of different areas of Inward containers after modification

	Very Good	Good	Average	Poor	Very Poor
Pallet Condition	30%	70%			
Wrapping		30%	40%	30%	
Stacking	30%	70%			
Packaging		70%	30%		
Product Quality		100%			

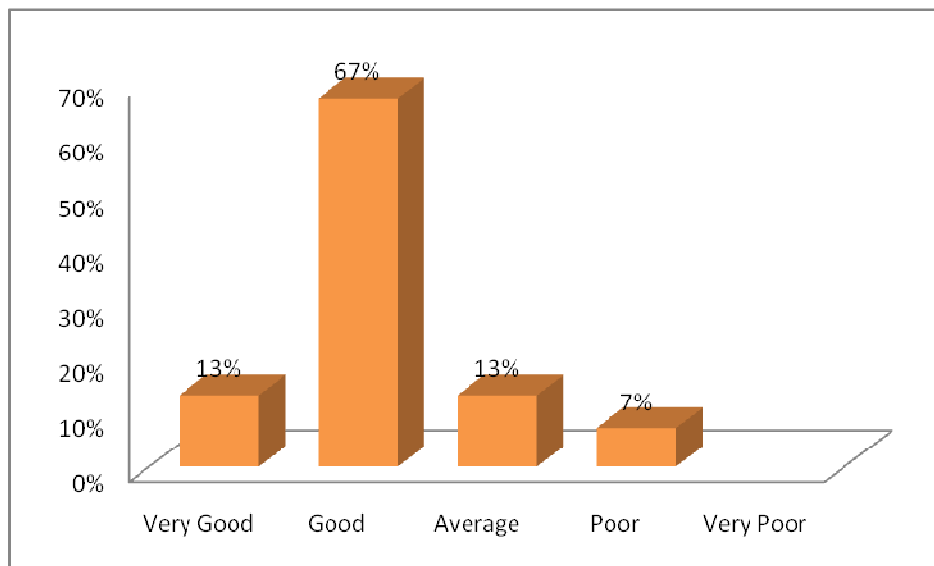


Figure 5- General condition of "inward" containers of the Pizza Boxes after modification

Having compared figures 4 and 5, the impact of buyer's feedback on the performance of the manufacturer is significant, since the proportion of poor aspects in each container was reduced from 50% to 7%. In contrast, the proportion of good and very good aspects of containers has increased from 20% to 80%. The improvement trend on the quality of the containers is depicted in figure 6. It shows that the regular feedback and information from the food distribution company has addressed the continuous improvement of the manufacturer's performance.

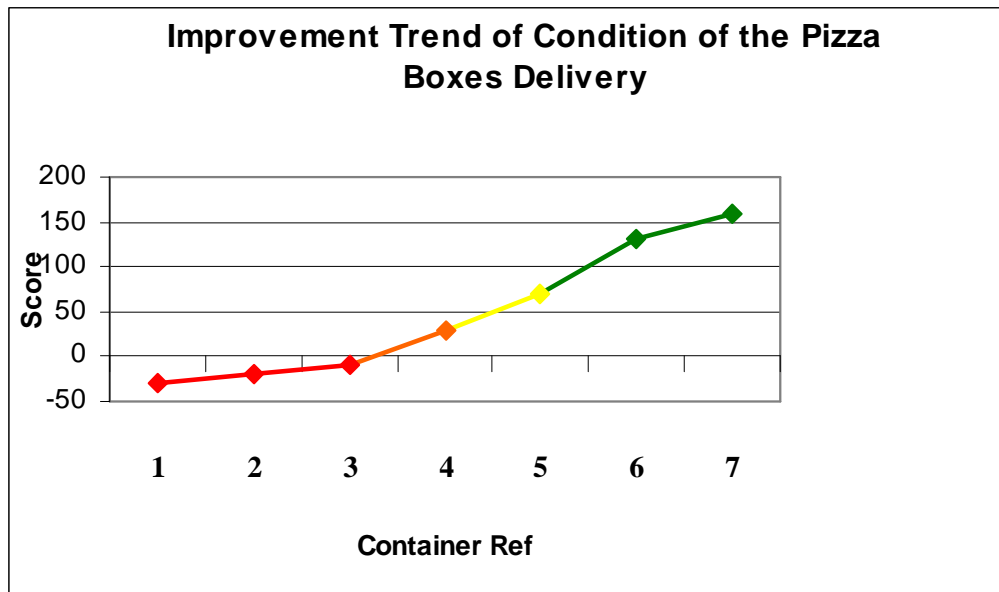


Figure 6- Improvement trend on the quality of supplier's performance to meet the customer's criteria in different delivery aspects

5. Conclusion and Future Study

It is concluded that, supplier development practices in a food supply chain have dramatic impact on the supplier's performance in providing better service and product quality for the end consumer. The result in figure 6 represents that quality of five different delivery aspects improved significantly from average score of -30 to more than 150 for the "In goods" container after developing the supplier performance. There are different approaches and practices of the supplier development which could be adopted to improve the performance of the supplier. According to the literature review, the attribute of the supplier development for this specific case would be the basic, direct and reactive approach which contains the elements of regular information sharing, feedback, supplier evaluation and basic communications. This type of approach is important in complex supply chain networks such as food supply chain where the flow of information path might be different with the flow of goods path.

It is recommended to have more research studies on the systematic approach to detect the root causes of the defect in this case. The Six Sigma methodology of DMAIC (Define, Measure, Analyse, Improve, Control) is a reactive method to find the root causes of the defect and optimum solution. The methodology of DMAIC is a reactive approach to develop the supplier, since the Design for Six Sigma (DFSS) is a proactive approach which helps the supplier to improve the performance.

References

- [1] Giunepero, L.C. and Brand, R.R., "Purchasing: Role in Supply Chain Management", *the international journal of logistics Management*, Vol.7, No.1, (1996), 29-38.
- [2] Fawcett, S.E and Fawcett, S.A., "The firm as a value-added system: Integrating logistics, operations and purchasing", *International journal of physical distribution and logistics management*, Vol.25, No.5,(1995), 24-42.
- [3] Cristobal Sanchez, R.; Hemsworth, D; Martinez-Lorente, A.R, "The effect of supplier development initiatives on purchasing performance: A structural model", *Supply Chain Management: An International journal*, Vol.10, No.4, (2005), 289 – 301.
- [4] Lo, V.H.Y and Yeung, A., "Managing quality effectively in supply chain: A preliminary study", *Supply Chain management: An International journal*, Vol.11, No.3, (2006), 208-215.
- [5] Williams, S., "A supplier development programme: The SME experience", *Journal of small business and enterprise development*, Vol.14, No.1,(2007), 93-104.
- [6] Krause, D.R; Ellram, L.M., "Critical elements in supplier development", *European journal of purchasing and supply management*, Vol.3, No.1, (1997a), 21 – 31.

- [7] Krause, D.R; Ellram, L.M., "Success factors in supply development", *International journal of physical distribution and logistics management*, Vol.27, No.1, (1997b), 39-52.
- [8] Hartley, J.L. and Choi, T.Y., "Supplier development: Customer as a catalyst of process change", *Business horizon*, Vol.39, No.4, (1996), 37-44.
- [9] Krause, D.R; Handfield, R.B; Scannell, T.V., "An empirical investigation of supplier development: reactive ad strategic processes", *Journal of operations management*, Vol.17, (1998), 39-58.
- [10] Carr, A.S. and Kaynak, H., "Communication methods, information sharing, supplier development and performance", *International journal of operations and production management*, Vol.27, No.4, (2007), 346-370.
- [11] Krause, D.R., "The antecedents of buying firm's efforts to improve suppliers", *Journal of operations management*, Vol.17, No.2, (1999), 205-224.
- [12] Krause, D.R., "Supplier development: Current practices and outcomes", *International journal of purchasing and materials management*, Vol.33, No.2, (1997), 12-19.
- [13] Prahinsky, C. and Benton, W.C., "Supplier evaluations: Communication strategies to improve supplier performance", *Journal of operations management*, Vol.22, No.1, (2004), 39-62.
- [14] Krause, D.R; Scannell, T.V. and Calantone, R.J., "A structural analysis of effectiveness of buying firm's strategies to improve supplier performance", *Decision sciences*, Vol.31, No.1, (2000), 33-55.
- [15] Wagner, B.A; Fillis, I. and Johansson, U., "An exploratory study of SME local sourcing and supplier development in the grocery retail sector", *International journal of Retail and Distribution management*, Vol.33, No.10, (2003), 716-73.
- [16] Forker, L.B. and Hershauer, J.C., "Some determinants of satisfaction and quality performance in the electronic components industry", *Production and Inventory management journal*, Vol.41, No.2, (2000), 14-20.
- [17] Gatt, J.D.A and Dale, B.G., "Supplier development: A British case study", *International journal of purchasing and materials management*, Vol.27, No.1, (1991), 16-22.
- [18] Hahn, C.K.; Watts, C. and Kim, K.Y., "Supplier development program: A conceptual model", *International journal of purchasing and materials management*, Vol.26, No.2, (1990), 2-7.
- [19] Wagner, S.M., "Supplier development practices: An exploratory study", *European journal of marketing*, Vol.40, No.5/6, (2006), 554-571.
- [20] Hartley, J.L. and Jones, G.E., "Process oriented supplier development: Building the capability for change", *International journal of purchasing and materials management*, Vol.33, No.3, (1997), 24-30.
- [21] Watts, C.A. and Hahn, C.K., "Supplier development programs: An empirical analysis", *International journal of purchasing and materials management*, Vol.29, No.2, (1993), 11-17.
- [22] Krause, D.R. and Ellram, L.M., "Success factors in supplier development", *International journal of physical distribution and logistics management*, Vol.27, No.1, (1997), 39-52.
- [23] Lascelles, D.M and Dale, B.G., "Examining the barriers to supplier development", *International journal of quality and reliability*, Vol.7, No.2, (1990), 46-56.
- [24] Ellram, L.M., "Partnering pitfalls and success factors", *International journal of purchasing and materials management*, Vol.31, No.2, (1995), 36 – 44.
- [25] Monczka, R.M, Peterson, K.J, Handfield, R.B. and Ragatz, G.L., "Success factors in strategic supplier alliances: The buying company perspective", *Decision science*, Vol.29, No.3, (1998), 553-557.
- [26] McCutcheon, D. and Stuart, F.T., "Issues in the choice of supplier alliance partners", *Journal of operations management*, Vol.18, No.3, (2000), 297-301.
- [27] Fung, P., "Managing purchasing as supply chain context – evolution and resolution", *Logistics information management*, Vol.12, No.5, (1999), 362-366.
- [28] De Toni, A; Nassimbeni, G. and Tonchai, S., "Service dimensions in the buyer – supplier relationship: A case study", *International journal of physical distribution and logistics management*, Vol.24, No.8, (1994), 4 – 14.
- [29] Carr, A.S. and Pearson, J.N., "Strategically managed buyer – supplier relationships and performance outcomes", *Journal of operations management*, Vol.17, No.3, (1999), 497 – 519.
- [30] Giunipero, L.C., "Motivating and monitoring JIT supplier performance", *Journal of purchasing and materials management*, Vol.26, No.2, (1990), 19-24.
- [31] Krause, D.R; Handfield, R.B; Scannell, T.V., "An empirical investigation of supplier development: reactive ad strategic processes", *Journal of operations management*, Vol.17, (1998), 39-58.
- [32] Wafa, M.A; Yasin, M.M, and Swinehart, K., "The impact of supplier proximity on JIT success: An information perspective", *International journal of physical distribution and logistics management*, Vol.26, No.4, (1996), 23-34.
- [33] Aghazadeh, S.M, "Improving logistics operations across the food industry supply chain", *International journal of contemporary hospitality management*, Vol.16, No.4, (2004), 263-268.
- [34] Cannon, J.P. and Perreault, W.D.JR, "Buyer – Seller relationships in business markets", *Journal of marketing research*, Vol.36, No.4, (1999), 439-460.
- [35] Noordewier, T.G; John, G. and Nevin, J.R., "Performance outcomes of purchasing arrangements in industrial buyer-vendor relationships", *Journal of marketing*, Vol.54, No.4, (1990), 80-93.
- [36] Quayle, M., "Supplier development for UK small and medium –sized enterprises", *Journal of applied management studies*, Vol.9, (2000), 117-38.

- [37] Hendfield, R.B; Krause, D.R; Scannell, T.V, and Monczka, R.M., "Avoid the pitfalls in supplier development", *Sloan management review*, Vol.41, No.2, (2000), 37-53.
- [38] Stuart, F.I., "Supply-chain strategy: organizational influence through supplier alliances", *British journal of management*, Vol.8, No.3, (1997), 223-236.
- [39] Bhatt, G.D., "An empirical examination of the effects of information systems integration on business process improvement", *International journal of operations and production management*, Vol.20, No.11, (2000), 1331-1359.
- [40] Dewett, T. and Jones, G.R., "The role of information technology in the organization: A review, model and assessment", *Journal of Management*, Vol.27, (2001), 316 – 346.
- [41] Carr, A.S. and Smeltzer, L.R., "The relationship between information technology use and buyer – supplier relationships: An exploratory analysis of the buying firm's perspective", *IEEE Transactions on engineering management*, Vol.49, No.3, (2002), 293 – 304.
- [42] Humphreys, P.K; Li, W.L. and Chan, L.Y., "The impact of supplier performance", *Omega: The international journal of management science*, Vol.32, (2004), 131-143.
- [43] Argyris, C., "Education for leading – learning", *Organisational Dynamics*, Vol.21, No.3, (1993), 5-17.
- [44] Seng, P., "The fifth discipline: the art and practice of the learning organization", *Doubleday currency*, New York, (1990), NY.
- [45] Wilding, R. and Juriado, R., "Customer perceptions on logistics outsourcing in the European consumer goods industry", *International journal of physical distribution and logistics management*, Vol.34, No.8, (2004), 628-644.
- [46] Fawcett, S.E. and Cooper, M.B, "Logistics performance measurement and customer success", *Industrial marketing management*, Vol.27, No.4, (1998), 341 – 357.
- [47] Cronin, J.J. and Taylor, S.A., "Measuring service quality: A reexamination and extension", *Journal of marketing*, Vol.56, July, (1992), 55 – 68.

Glossary

Small-to-Medium Size Enterprise (SME) – Any enterprise with less than 250 employees

Supply Chain management (SCM) - managing different levels of internal or external organizational transactions which generally represent the flow of goods and flow of information

Supplier Development - supporting the supplier in enhancing the performance of their products and services or improving the supplier's capabilities

DMAIC – The common problem solving methodology of Six Sigma (Define the defect and customer requirements, Measure the current performance, Analyse the root causes of the defect, provide improvement solutions, monitor and control the solutions)

