

Performance Assessment of a Bangladeshi E-commerce Enterprise: A Case Study

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Abstract

This research has assessed the performance of a reputed Bangladeshi e-commerce enterprise as a case study to unearth the glitches in operations and supply chain of e-commerce industry. The study has three parts namely identifying and evaluating the magnitude of potential failures in relevant processes; inventory analysis; and correlating the failures with various inventory classifications. Service mapping or blueprint were created to understand the standard of operations in the enterprise. Failure Mode Effect Analysis (FMEA) tool was used to measure the magnitude of the problems and possible solutions. In addition, ABC analysis was used to classify inventory in three different categories. The analysis of data reveals that mistake in order taking and processing, warehouse mismanagement; and in-appropriate delivery are major failure points with significant impact on operations.

Keywords: e-Commerce, Operations, Supply Chain Management, Service Mapping, Failure Mode Effect Analysis, Inventory Classification, Warehouse Management.

1. Introduction

Electronic commerce (e-commerce) has rapidly grown in terms of transactions all over the world (Business Insider, 2017). Bangladesh is one of the most densely populated countries in the world with a population size of 166 million and nearly half of these populations are internet users (Islam, 2018; WPP, 2018). Despite the fact that there is a large potential of e-commerce business in Bangladesh, the growth is still low, only 4.8%,

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compared to 28% and 34% in Pakistan and India respectively (Islam et al, 2015). It is believed that infrastructure, culture, and attitude are the main barriers to e-commerce (Debnath & Mahmud, 2007). However, the situation is significantly changing in Bangladesh with increasing number of e-commerce platforms and foreign direct investments in the sector. There are many driving factors for this trend which include high speed internet connectivity, busy schedule of consumers and enhanced electronic money transaction infrastructure among others.

The e-commerce operators often have difficulties in product sourcing, encounter lack of coordination with delivery partners, face issues related to quality, accuracy and on time delivery (Lin, 2011). In summary, the enterprises in the sector are often bogged down by a variety of operations and supply chain related issues. This research, in view of the situation in the sector, conducted a case study on a reputed Bangladeshi e-commerce enterprise to unearth the operations and supply chain related problems, causes and subsequent effect on the organization.

2. Literature

The e-commerce enterprise deals with a large quantity of inventories. The operations and supply chain failures occur in dealing with these inventories. However, all inventories are not equally valuable. Therefore, inventory classification is required. ABC classification is a commonly applied inventory classification technique where all inventories are classified into three categories namely A, B and C in terms of importance. It is based on Pareto's principle or the 80/20 rule, which assumes that 20% of the items in a list will account for 80% of the significant measurement. ABC analysis has many benefits including in cycle counting where A class items will be counted more frequently than B or C class items (Stevenson et al., 2007). Order quantity and safety stock levels are also established according to the criticality and cost of each item. Usually this is approached from a monetary accuracy perspective. Inventory replenishment systems also vary according to the importance of the inventory items. For example, C class items may be controlled with a simple two-bin system if they are not particularly bulky (Ng, 2007). In addition, as A class items form a larger investment in inventory, these items are closely analyzed to ensure appropriate order quantities and safety stocks are used. Furthermore, A class items are always the focus of attempts to improve inventory turnover as changes in the way A class items are procured and managed will have the most significant effect on the overall inventory investment level.

To understand and solve the operations and supply chain problems impacting e-commerce enterprises in Bangladesh, it is imperative to identify the causes, effects and potential mitigation strategies regarding the problems. A potent tool for the above-mentioned purpose can be Failure Mode Effect Analysis (FMEA), which is a system reliability and safety review technique created in the 1960s as part of the U.S. Minuteman rocket program to find and mitigate unanticipated design problems. FMEA is a proactive analysis tool allowing engineers to define, identify and eliminate known and/or potential failure, problems, errors and so on from the system, design, process and service (Stamatis, 2003). Such a tool is used to analyze process and allows to identify areas of the process that most impact customers. It also helps to identify how the process is most likely to fail and points of process failures, which are most difficult to detect (Gary et al., 2016).

A successful FMEA activity helps a team to identify potential failure modes based on the experience with similar products or processes or problems, enabling the team to design those failures out of the system with minimum efforts and resourced expenditure, thereby reducing development time and cost. The technique has successfully been utilized to analyze service and manufacturing processes by researchers and practitioners. However, understanding the process is a prerequisite to use FMEA tool. For that to happen, service maps or blueprints are needed to be created. Service mapping simultaneously depicts the service process, the points of customer contact, and the evidence of service from the customers' point of view. Service maps are used in operations management to assess whether the service is rendered as promised and manages failures, training systems, and quality control (Fitzsimmons et al., 2008). Typical service mapping starts with identifying the process to be mapped, followed by identifying the customer segment. The next step includes mapping the process from the customer point of view and resultant action of the service delivery staff. The service mapping literature further suggests documentation of evidence that is tangible items that the customer comes into contact during the service delivery process.

3. Methodology

In view of the discussion provided in the previous section, this research pursued the following objectives:

Objective 1: Conduct ABC Classification of inventories in the e-commerce enterprise

Objective 2: Map typical operations and supply chain related service processes in the case study organization

Objective 3: Conduct FMEA of the processes and suggest problem mitigation approaches.

Objective 4: Correlate process failures with category of inventories

This research predominantly used the case study method to investigate the problem*. The organization studied is an e-commerce start-up venture in Bangladesh. The enterprise is an online lifestyle store. The inventory available at the online store includes a range of fashion products, gadgets and electronic items. The enterprise operates a front office, back office and multiple logistics facilities including warehouses and transportation capacity. Researchers have previously advocated the use of case study method to generate qualitative data (Lambert et al., 1996; Geertz, 1994) especially when investigating contemporary issues (Yin, 2013). The research deemed that qualitative data was required to understand and map the processes.

The research team conducted field visits at the warehouse, distribution center and corporate office premises of the selected organization. The research team conducted multiple semi-structured interviews with mid and top-level management; had informal discussion with employees; and observed various operational activities and business processes. The major topics of discussions in the semi-structured interviews are as follows:

- Major processes
- Problems in executing processes
- Impacts of the problems identified
- Reasons behind the problems
- Potential mitigation strategies to solve the problem
- Inventory control.

In addition, the management of the organization studied shared official reports related to customer complaints; inventory assessment and turnover; and warehouse capacity status. The interviews were recorded, and research memo created. The data was coded and analyzed.

ABC analysis was conducted using combination of interviews and assessment of existing documents and performance reports. After successful mapping of the business process, FMEA tool was used to identify

* Fitzsimmons, J. A., & Fitzsimmons, M. J. (2004). *Service management: Operations, strategy, and information technology*: Irwin/McGraw-Hill.

- the fail points in the process; effects and mitigation strategies. An elicitation exercise was carried out to generate data required for the use of FMEA. Elicitation is a process of formulating a person's knowledge and belief about one or more uncertain quantities into a (joint) probability distribution for those quantities. The operations manager of the case study organization participated in the exercise. The manager was chosen for the exercise because of his extensive experience, knowledge and expertise on the studied process. Correlation between failures and category of inventory was developed using subjective judgment acquired through interviews and informal discussion with staff. Table 1 provides details of the interviews and the elicitation exercise. Further details on the elicitation exercise are provided in the results section.

Table 1: Interview details

Interviews	Elicitation Exercise
Participants: 5	Participants: 1
Interview type: semi-structured	Interview type: Structured, FMEA sheet used
Length: 40- 60 minutes	Length: 2 sessions (40- 60 minutes each)
Role in the organization: Warehouse manager, operations manager, logistics and delivery in-charge	FMEA sheet populated
Transcripts were created	

4. Results and Discussion

This section presents the results of this study and interprets the findings. Section 4.1 summarizes the findings of the ABC analysis. Section 4.2 discusses the service map and results of FMEA, followed by assessment of correlation between identified process failures and inventory categories (section 4.3).

4.1 ABC Analysis

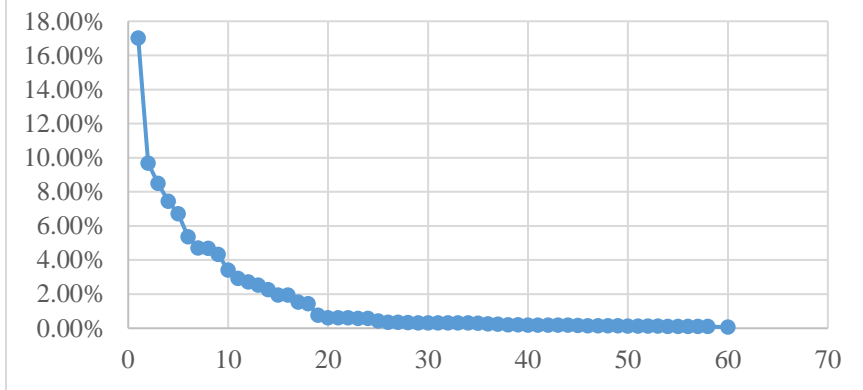
The research started with the ABC analysis of inventory at the organization. The analysis was done through a combination of existing document analysis and semi-structured interviews. It should be mentioned that the analysis was not exhaustive; in total 60 Stock Keeping Units (SKU) were analyzed. These inventories were mostly kept at the enterprise's own warehouse. Consumption value is needed in order to categorize the inventories. The equations to calculate the consumption value and percentage of total consumption value are provided below. The equations were applied for each item or SKU. Figure 1 illustrates the percentage of consumption value in BDT by item (SKU) in the decreasing order.

Equation 1: Consumption value by item (SKU) = Per unit value of item × Annual usage of item

Equation 2: Percentage of consumption value by item (SKU)

$$\frac{\text{Consumption value by item (SKU)}}{\text{Total consumption value}} \times 100$$

Figure 1: Percentage of consumption value (in BDT) by item (SKU)



A category inventories: A category items are goods for which the annual consumption value is the highest. The range of price is between BDT 5,250,000 and BDT 1,450,000. The top 59.39% of the annual consumption value of the company typically accounts for only 11.6% of total inventory items.

B category inventories: B category items have medium consumption value. The range of price is BDT 1,450,000 to BDT 450,000. 30% of annual consumption value typically accounts for 16.5% of total inventory items.

C category inventories: C category items are on the contrary items with the lowest consumption value. The range of price is BDT 1,440,000 to BDT 19,500. The lower 20% of the annual consumption value typically accounts for 71.1% of total inventory items.

4.2 Service Map and FMEA

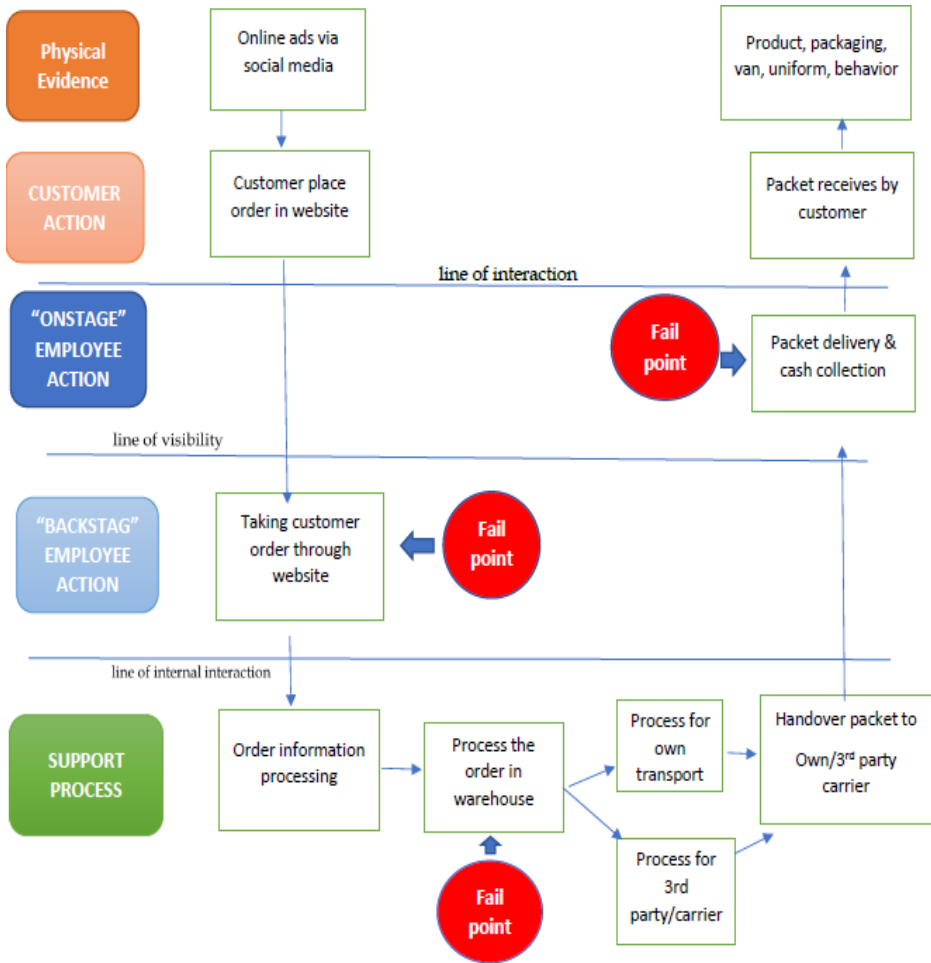
The major supply chain and operations related activities of the e-retailer include sourcing, storing, processing and distribution. Following is a discussion on each of those activities.

Sourcing: These activities are tactical in nature. The business development and procurement teams continuously collaborate on negotiating deals and

terms with suppliers. However, detailed assessment of the sourcing practices was not possible due to unavailability of data.

Storing: After receiving the products, the quality assurance department of the organization checks the quality of the products. After the quality assurance process is completed the inventory is stored according to the shelf plan and database updated.

Figure 2: Service blueprint of the customer order management process



Processing: After an order is placed, the warehouse processing unit completes the shelf picking and packaging work and the inventory is ready for transportation.

Distribution: Depending on the product type and inventory management decision, products are transported using in-house or third-party transportation.

Based on the analysis of the interviews conducted, a service map or blue print of the order management process of the organization is created (Figure 2). The service blueprint is based on a standardized format and utilized by many researches and industry reports (Chuang, 2007; Geum and Park, 2011; Park, 2011; Baum, 1990).

It should be mentioned that the customer order management process encompasses two of the major operations and supply chain activity of the organization namely processing and distribution. As explained in the literature review section, a service blueprint maps the process from the customers' point of view. The service is triggered by the customers' action of placing an order. In general, there is no customer interaction with any onstage employee; the former refers to staff of the organization having face-to-face or over the phone communication with customers. The line of visibility means beyond this point the customer has no knowledge of the e-retailers action regarding the order. The customer order is processed by backstage employees of the organization and request is posted in the information system for the warehouse. The latter upon inventory picking and packaging handover the product to own- or third-party transporter for customer delivery. All these activities can be considered support sub-processes. The product is finally delivered to the customer by on-stage employees and the interaction is visible to the customer. The physical evidences refer to tangible matters that the customer comes into contact in acquiring the service. In the process the physical evidences examined includes the dissemination materials that the customer comes in contact such as advertisements, the final product, packaging, and the delivery person's belongings. This research identified three potential fail points in the customer order management process which include: i) placement of accurate order from customer, ii) processing the order in warehouse, and iii) delivery. Fail points or failure modes are the way in which a process could fail to perform its intended function. It refers to matters that can go wrong with detrimental consequences.

The identification of the fail points allowed this research to conduct the FMEA. This is critical since assessing the significance of the potential failures is requisite to take corrective actions by the organization. FMEA assesses failures on three criteria namely severity, occurrence and detection

capacity. Severity determines the importance of the effect on operations in case the failure occurs. Table 2 summarizes the root causes of the fail points and potential mitigation strategies. This section further summarizes the issues in detail.

Table 2: FMEA rating scales

Fail Points	Reasons for the Problem	Mitigation Strategy
Accuracy of customer order upon placement	Inaccurate data entry by the backstage employees	Upgrade information system
Processing the order in warehouse	Mismanagement resulting in picking wrong inventory for packing	Enhanced training Improve monitoring of employees Automate inventory control using in house delivery and transport service
Delivery	Use of third-party delivery service Inaccurate handover of inventory by the warehouse	Enhanced training Improve monitoring of employees Automate inventory control

Occurrence stands for frequency at which a certain cause occurs and generates a failure mode; whereas the existing robustness of the system to prevent the failure is termed detection. As mentioned in the methodology section, an elicitation exercise was carried out to get subjective judgment regarding the severity, occurrence, and capacity of the system to detect the failures. The operations manager of the case study organization participated in the exercise as an expert. The participant of the elicitation exercise was asked to rate each failure in a scale of 1-to-5 across the three criteria. Table 3 provides details of the scale and interpretation. This research using the expert assessment calculated the risk ratings of the failures identified. Equation 3 is used to calculate the Risk Priority Number (RPN).

Table 3: FMEA rating scales-2

Severity (S)	Occurrence (O)	Detection (D)
Range: 1- not severe, e.g., minor effect on operations	Range: 1- Unlikely to occur	Range: 1 – Confidence to either find or prevent the failure
Range 5- very severe, e.g., severe effect on operations	Range 5– Regularly occurs based on existing data	Range: 5: System unlikely to prevent failure

Equation 3: $RPN = Severity (S) \times Occurrence (O) \times Detection (D)$

Applying equation 3, RPN ratings for all the three fail points are calculated. Table 4 tabulates the results of the RPN calculations. It is apparent from the RPN ratings of the fail points that problems with delivery are the greatest risk, followed by customer order processing and inaccurate placing of customer orders. FMEA further includes assessment of the causes behind the problems and identifying potential mitigation strategies. The discussion below addresses the issues.

Table 4: RPN rating

No.	Fail Point	Severity (S)	Occurrence(O)	Detection (D)	RPN
1	Accuracy of customer order upon placement	3	4	2	24
2	Processing the order in warehouse	4	3	3	36
3	Delivery	4	4	3	48

Causes and potential mitigation strategies for fail point 1 (Accuracy of a customer order): the results of this research indicate that customer orders are often not accurately placed in the system. The fail point with an RPN of 34 can be considered medium risk. The main cause of the problem is inaccurate data entry by the backstage employees placing the order. The problem can be mitigated by simplifying the process. At present, once customer places an order, a ticket is raised which is processed by the backstage employees and subsequently the request is transferred to the warehouse and transportation department for action. This action by the backstage employee does not add much value and can be eliminated with customer order directly placed at the warehouse through the information system. Hence, it is suggested that the information system be upgraded with accurate visibility of inventory.

Causes and potential mitigation strategies for fail point 2 (Processing the order in the warehouse): the fail point has an RPN of 37 which is substantial and signifies that operation is hampered by this problem. The main cause of the problem is mismanagement resulting in picking wrong inventory for packing. To solve the problem, the organization should impart enhanced training and improve monitoring of employees working at the warehouse. In addition, the inventory control system can be automated by using bar code or RFID for inventory tracking within the warehouse.

Causes and potential mitigation strategies for fail point 3 (Inaccurate delivery): this is the most severe fail point impacting operations and supply chain activities of the organization. The RPN of the problem is 48. There are two reasons for this type of failures namely- use of third-party delivery

service and inaccurate handover of inventory by the warehouse. The first cause can be mitigated by using in house delivery and transport service where control would be higher. The second case is in fact related to fail point 2, hence similar solutions can be applied.

4.3 Correlation between Process Failure and Inventory Category

The overall failure in process was found to be 11.5%. This research further analyzed and correlated the process failures with inventory categories. Table 4 illustrates the results. Care should be taken while interpreting the results of table 3. For example, 2% “delivery” related failures for A category inventory means, among the total delivery related failures 2% were related to A category inventories. For the process failure “accuracy of customer order upon placement” 50% of instances were in the case of B category inventories and 43% failure occurred in dealing with C category inventories. 5% of the A order processing failures occurred while dealing with B category inventories; whereas 40% and 55% were B and C category respectively. The data shows similar trends for delivery failures with as high as 63% failures occurring for C category inventories.

It can be interpreted that the current process adequately addresses replenishment, distribution and tracking of A category inventories as illustrated by low percentages of failures in relation with inventory of such category.

However, it should be of concern that majority of failures are related with B category inventories. The overall failures percentage should be reduced by steps suggested in the previous section.

Table 4: Failure percentage - inventory category wise

No.	Fail Point	Severity (S)	Occurrence(O)	Detection (D)	RPN
1	Accuracy of customer order upon placement	3	4	2	24
2	Processing the order in warehouse	4	3	3	36
3	Delivery	4	4	3	48

5. Conclusion

This research had an agenda to understand operations and supply chain problems hampering e-retailers in Bangladesh. In this regard, a typical customer order management process was mapped and FMEA tool was used to analyze the performance of operations. In addition, inventory classification technique such as ABC analysis was used. The results indicate

that the failures, such as inaccurate delivery; wrong processing of order at the warehouse; and mistakes in order placement are significant issues, which need to be resolved.

The research further revealed that there is a failures percentage of 11.5% in the processes analyzed which needs to be reduced. Correlation analysis between the process failures and category of inventory, for which the failure occurs, indicates that a high percentage of failure occurs for B and C category inventories, whereas the results are acceptable in case of A category inventories. The research suggests that the management of the e-business enterprises should consider implementing process simplification, electronic inventory control system, enhanced training of front stage and backstage employees to mitigate the current failures. In particular, attention needs to be paid for reducing failure occurrences of B category inventories.

The findings of this research are based on a study conducted only in one e-commerce enterprise. Further research needs to be conducted in order to generalize the findings of this research. Besides, a comprehensive quantitative research method, such as sample survey, in multiple e-commerce enterprises needs to be pursued based on the findings presented in this research.

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