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The Relationship Between Problematic Materials and Successful Transaction Counts: A Case of Electronic Manufacturing Services Industry

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Abstract: Material/purchasing department is one of the essential departments in ensuring the sustainability of organisations; no matter indirect or direct material purchase. Hence, compliment of the requirement and characteristic of the purchased materials and parts are significance to the smoothness of production and operation to consistently meet the customer requirements. However, the problematic materials and parts shipped by the appointed suppliers are creating issues and common problems impacting the sustainability of organization. Those materials and parts that are failed to comply with the basic requirement will be quarantine until their identity verified and time consuming. This will directly impact production date and totally a waste of human resource where buyers need to allocate their time and attention to solve these problematic materials and parts. Therefore, this study tends to figure out which category of problematic. Besides, this study also aims to investigate which category of problematic is significance to the successful transaction count to the Electronic Manufacturing Services (EMS) industry and what are the relationship between each problematic category and their significance to successful transaction count to EMS. The result reveals that Without Certificate of Conformance (COC) problematic is the top contribution problematic. We also noticed that there are relationships between the sixteen problematic categories and most of their changes do not significantly affect the successful transaction to EMS.

Key words: Electronic manufacturing services, multivariate analysis, attention, compliment, Malaysia

INTRODUCTION

Over the past decade there has been a growing realization of the important contribution that purchasing and supply management can have on firm performance (Cousins *et al*., 2006). As firms recognized the importance of purchased inputs to their products, the purchasing department function's role has increased in importance as well in the global industry. Interest in purchasing activities increased dramatically as companies sought to gain a competitive advantage in the evolving global marketplace. As today, firms need to strategically acquire the materials and services that will enhance their ability to meet their customer's needs (Carr and Pearson, 2002).

Purchasing management is concerned with the acquisition of supplier's goods and resources, in order to contribute to the administrative and strategic objectives of the organizations. In practice, purchasing managers have to respond creatively to internal customers need on the one hand and to maintain a mutually profitable relationship with suppliers on the other hand (Fung, 1999).

Purchasing can be divided into two broad categories, large and small purchases, based on seven characteristics of purchased product volume, specificity, technological complexity, essentiality, fragility, variability and economic value (Laios and Moschuris, 2001; Gonzalez, 2002). In manufacturing firm practices, the purchasing category can be divided into electronic components such as capacitors, resistors, transistors, integrated circuit, printed circuit board, in-plane switching and others. Although, purchasing management function gained its importance in the firm's strategic objectives, purchasing of raw material, parts, and services is a costly function in most of the organizations. Given the significant impact of purchasing, organizations are constantly striving to fine-tune their purchasing processes to reduce the costs associated with purchasing and increase accountability and transparency (Joyce, 2006).

Besides, purchasing function in the industry nowadays is too much concern about cost efficiency through centralized procurement strategy. However, the incoming supplied materials issues should also be

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highlighted as one of the efficiency agenda and should be highlighted as the impact of problematic materials would impact production line. A common and general issue in the manufacturing firms, the incoming materials issues had been a repetitive and continuous as these issues may Impact firm's revenue as goods are unable to be ship to the customers upon promised delivery date. The purchasing cycle begins with a request from within the organization to purchase material, equipment, supplies, or other items from outside the organization and the cycle ends when the purchasing department is notified that a shipment has been received in satisfactory condition. In real practices, manufacturing firms will schedule a customer's demand forecast in order to spare purchasing materials for future demand. Upon receive customer's purchase order, purchaser will be assigned to purchase the requested materials accordingly, purchaser must seek permission from the customer to determine which materials part should purchase from which vendors. This is to secure manufacturing firm's final goods is recognized and accepted by the customer. Next, purchaser will proceed to issue purchase order to the approved vendors with specific requirement and characteristic of the purchased materials prior to supplier's lead time and payment.

Vendors are responsible to ensure material parts requested to be comply with the requirement and characteristic before ship out. Furthermore, expediting activities are also necessities in purchasing activities where sometimes vendors are not able to commit the requested date. In addition, consignment tracking upon materials parts shipped out from vendors is a must activity to ensure that shipments are on schedule and will arrive on time.In a nutshell, purchasing department roles not only concern about the acquisition of raw materials. At the same time, purchasing department function is also liable to educate and communicate the vendors to ship the requested material parts with complete information regarding requirement and characteristic fulfillment. In short, the highlighted point is when incomplete information regarding requirement and characteristics about the supplied material parts would cost critical issues to the whole supply chain. To extend, upstream vendors and purchaser should communicate and work hand on hand to ensure supply chain activities are managed smoothly at the same time obtaining mutually benefits by achieving both parties win-win strategy.

Problems to be addressed: Purchasing department's function is to purchase all necessary material parts demanded by the firms for production from external sources into the firms. Hence, communication between two parties is the key success towards successful buying process. In order to ensure where there has no single possibility of any failing, the purchasing activities information flow should be as smooth as possible thru and from both parties.

Adverse, the setback of miscommunication will lead to critical crisis which would heavily impact production, as well as organization reputation. To be emphasized in EMS industry, problematic parts from different suppliers is the concern; this may due to lack of inter-exchange information and communication issues among both parties. Problematic material can be commonly categorized into several problems such as shipment without or incomplete supplier label, shipment mix date code, Shipment Wrong Manufacturer ID, shipment without Certification of Conformance (COC), shipment quantity not match and Manufacturer Part Number (MPN) not match. These problematic material parts generally will be inspected by receiving team before proceed to EMS. Materials which are quarantined in problematic storage will be rectified by purchasers accordingly to the problematic issues. This rectification process of the problematic shipment is crucial and important because the status and identity of the materials is not yet been verified.

The consequences of applying unverified material parts may prompt machine broke down lastly production line down. Therefore, sufficient information about the material parts shipped by the vendors in the aspect of requirements and characteristics fulfillment is very significant. Incoming problematic parts maybe seen as a small particular and inconspicuous in the whole purchasing activities but overlooking of these tiny particulars may causes huge damage loss to the organization. Hence, problematic material parts should be treated as major concern in order to cut down possibility of line down and failure to commit customer request date. Communication and cooperation from both parties especially vendors while preparing shipment to make sure all requirement and characteristic of the requested material parts are complete upon delivery.

Firstly, problematic incoming material parts may impact production Clean To Build (CTB) date. Clean to build date is the date where all the required materials and parts are on time delivered and transacted into warehouse waiting for kitting process then finally to production or assembly line of the scheduled products will start. Each product will have their own manufacturing lead time and commit date to the respective customers; therefore, problematic material parts will directly affect the CTB date. As an example, most of EMS industry practices Just In Time (JIT) operation strategy. The principle of JIT operation strategy is to deliver the right material at the right time to the right place in the right amount of

materials. To extend, the problematic materials will be quarantine until the problematic issues resolved by the purchasers and lastly transacted into EMS industry.

Upon shipment successful transacted into EMS industry, this will notify the production line that the materials and parts are ready for kitting and to be used in the production line side. To conclude, incoming problematic parts will directly impact the CTB date. Hence, this would impact organizational revenue, performance and at the end may affect company reputation. Secondly, problematic material parts signal extra attention and extra time allocate to resolve the problematic issues. To specify, problematic issues will lead to wastage of human resources and time. At first, purchaser's duty is to purchase and ensure the required materials and parts to build customer's order goods are allocated appropriately with no difficulties. At the same time, purchasers also carry on expediting activities and shipment tracking upon delivery from the vendors. Problematic parts are mostly those materials that do not meet the basic information requirement of EMS industry.

Therefore, shipment will be on hold quarantined by receiving team in problematic storage. Upon received notification from problematic team, purchasers have to allocate extra time to resolve the issues by searching the information from the database or respond the issues to the suppliers. A part of it, EMS's suppliers also have their respective manufacturers and this is where the problem arises. The feedback time from upstream suppliers is time consuming and incurred cost inefficiency. The purchasers have to spend extra times to seek feedback advice on the problematic issues by mailing and calling international direct dial. This even obvious when purchasers need to call different region suppliers when the time zone is different sometimes, it is necessary to stay up after working hours to conference call with the Europe and American suppliers.

Therefore, the purpose of the study is to identify which category of problematic contributes the most at problematic quarantine and to investigate which category of problematic is significance affect the successful transaction count into EMS industry. Besides that, this study will determine the relationship between each problematic category and their significance to successful transaction count to EMS industry. In a nutshell, identification of these problematic root causes and finding a proper and accountable solution must be taken in order to cut down problematic counts. Suppliers and company should be together and responsible to boost up production efficiency. Therefore, suppliers should play their role to ship the ordered parts by EMS industry as required and compliment of the characteristic. At the same time, EMS industry should also cooperate to manage accurate parts requirement information and share transparently with the suppliers to avoid repetitive of the problematic parts. Meanwhile, education should be given to the suppliers when they repetitively shipped problematic parts and should be penalize. In short, both supplier and EMS industry hold the firm responsibility to cut down problematic by cooperation and transparency between both parties.

MATERIALS AND METHODS

A quantitative methodology is employed to identify and measure the relationship and significance by using different statistical techniques including Multiple Regression and Correlation analysis. Both of these analysis techniques will do using Statistical Package for Social Science (SPSS). In this study, the data was collected from one of the EMS industry located in Malaysia. The data sets are from year 2014 where the data details included received date, quantity, company part number, purchase order number, problematic category, etc. (Table 1).

Table 1: Problematic table

Problematic	Description
No item line	Received parts not exist in the system
Without COC	Parts shipped without certificate of conformance
Without supplier label	Parts shipped without label from supplier
Without datecode	Parts shipped without datecode
MPN not match	Manufacturing part number not match with system
REV not match	Revision of the shipped parts not match with system
QTY not match	Quantity of parts shipped not match with system
Wrong MFR	Parts shipped with wrong manufacturer
Wrong PN	Parts shipped with wrong part number
Two PO	Parts shipped with two purchase order
Without conversion form	Parts shipped without conversion from
Mixed datecode	Parts shipped with mixed datecode
I code	I code parts shipped from supplier
Z code	Z code parts shipped from supplier
System 2 line	Parts shipped with two line in the system
Incomplete supplier label	Parts shipped incomplete label from supplier

The Pivot table of problematic categories and suppliers has been extracted from EMS problematic team and receiving team. A descriptive statistics was conducted to provides simple summaries about the sample and the measures and to identify the contribution of each problematic towards pending transaction parts. In addition, multivariate analysis was conducted in order to measure the relationship or degree of which variables are related to each other and to investigate the significant between each independent variable to the dependent variable.

RESULTS AND DISCUSSION

A descriptive statistics summary of each problematic category and supplier towards pending transaction parts was shown in pie chart as in Fig. 1.

From pie chart above, we obviously see that category of problematic contribute the most at problematic quarantine is without COC where this problematic occupied 40 percent with a total of 197 cases out of 492 cases of problematic. Furthermore, MPN not match occupied about 19% among the total counts with a total of 94 cases. In a nutshell, without COC problematic, MPN not match, without datecode, no line item and incomplete supplier label is the top five contributors to pending transaction counts into EMS industr problematic.

Based on the coefficient table generated by SPSS, no line item problematic, without COC problematic, two purchase order problematic, I code problematic and Z code problematic are statistically significance to successful transaction counts to EMS industry with their respective p-value are smaller or equal to 0.05. On the other hand, without date code, MPN not match, REV not match, wrong MFR, wrong PN, conversion form, mixed DC, system 2 lines and incomplete supplier label are not statistically significance to successful transaction counts to EMS industry with their respective $p \geq 0.05$.

The adjusted R^2 should be used to measure "goodness of fit" in a model that contains more than one independent variable. Based on the model summary table provided in Table 2, the adjusted R^2 value is 0.779. It was indicated that 77.9% of dependent variable can be explained by independent variables.

The F-test is a test for the overall fitness of the model. It tests the hypothesis concerning the selected independent variables that affect the dependent variable. The test criterion studies the F-test statistic where F (6.494) and p is 0.004 is smaller than 0.005 for the overall model. In other words, the results tell us that the independent variables should remain in the model.

The last objective of this study is to investigate what are the relationships between each problematic category and their significance to successful transaction count to EMS industry, therefore results from correlation is extracted and explained. There is positive relationship between no line item problematic and successful transaction to EMS industry where $r = 0.394$, $p = 0.046$. There is also positive relationship between without COC problematic; without datecode problematic; without supplier label problematic MPN not match problematic and REV not match problematic; where $r = 0.210$, $p = 0.303$; $r = 0.111$, $p = 0.591$; $r = 0.089$, $p = 0.666$; $r = 0.343$, $p = 0.086$ and $r = 0.102$, $p = 0.621$, respectively.

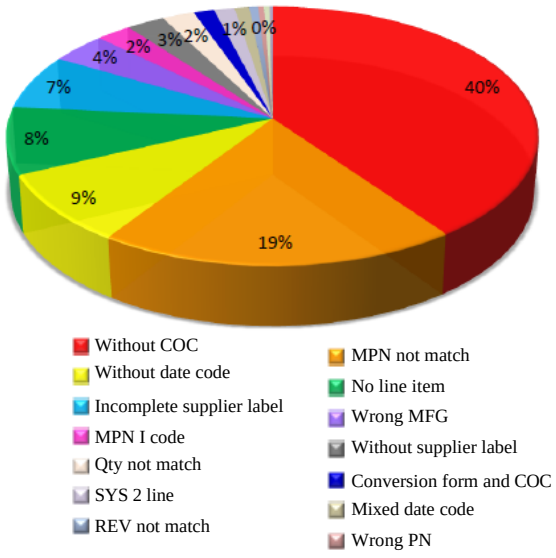

Fig. 1: Problematic percentage pie chart

Table 2: Model summary

Model	R	R^2	Adjusted R^2	SE of the estimate
1	0.959[a]	0.920	0.779	54.17037[b]

[a]Predictors: Constant, INCMPLT_SPLR_LBL, WRONG_MFR, SYSTEM_2_LINE, MIXED_DC, I_CODE, TWO_PO, WRONG_PN, WTH_SPLR_LBL, CONVERSION_FORM, Z_CODE, REV_NT_MATCH, WTH_DC, MPN_NT_MATCH, NO_ITEM_LINE, QTY_NT_MATCH, WTH_COC; [b]Dependent variable: TTL_SUCCESSFUL

Table 3: ANOVA

Model 1	Sum of squares	df	Mean square	F-value	Sig.
Regression	304884.6001[a]	6	19055.287	6.494	0.004[b]
Residual	26409.8620	9	2934.429		
Total	331294.4620	25			

[a]Dependent variable: TTL_SUCCESSFUL; [b]Predictors: Constant, INCMPLT_SPLR_LBL, WRONG_MFR, SYSTEM_2_LINE, MIXED_DC, I_CODE, TWO_PO, WRONG_PN, WTH_SPLR_LBL, CONVERSION_FORM, Z_CODE, REV_NT_MATCH, WTH_DC, MPN_NT_MATCH, NO_ITEM_LINE, QTY_NT_MATCH, WTH_COC

There is negative relationship between wrong manufacturer problematic and successful transaction to EMS industry where r = - 0.077, p = 0.710. There is also negative relationship between wrong part number problematic; two purchase order problematic; conversion form problematic; mixed datecode problematic and I code problematic where r = - 0.096, p = 0.641; r = 0.589, p = 0.002; r = - 0.101, p = 0.622; r = - 0.133, p = 0.517 and r = 0.339 , p = 0.09 , respectively.

CONCLUSION

As from the results, we are alert that without COC problematic, MPN not match problematic, No line item problematic without datecode problematic and incomplete supplier label problematic are the top five highest problematic material categories to pending transaction into EMS industry. We noticed that the main root cause of problematic is lack of information sharing and information transparency. As recommendation, purchasing department top management should sit around the table to discuss and come out with a proper solution. As a suggestion, the top management should highlight this issue to the respective suppliers so that they are able to understand the impact of delivered problematic materials to the production smoothness. Penalties should be confined to those suppliers who repetitively shipped problematic materials to EMS industry. The top management may consider organizing an annual suppliers rating conference to highlight and extend the concern. At the same time, both parties would discuss and come up with some policy or agreement another suggestion where win-win strategy proposal and improvement for current issues.

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