

A Study on the Factors Responsible for Product Adaptation of Genset in India

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Abstract

Product adaptation or customization is one among the most preferred strategies that manufacturers adopt to remain contemporary and competitive in the market. Customer prefer to purchase tailored products which suits to their specific needs. This behavior is very common among Institutional customer for their industrial goods needs. This article is aimed towards studying the critical factors that affects product adaptation with special reference to Genset Industry in India. A survey was conducted among 254 respondents of different Genset OEMs spread across in India with a goal to know the contribution of different factors affecting product adaptation of Genset. Through multiple linear regression using SPSS, a statistical software for data analysis it was observed that product adaptation of Genset was significantly affected by Internal process of the organization, Supply chain capabilities and customer preference. Hence manufacturers need to consider these three factors to decide whether predict adaptation is essential or not for their customers.

Keywords: Product adaptation, Genset, Customer Preference, Internal Process, Supply Chain.

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I. Introduction

To remain competitive in the market, manufacturers resort to different innovative practices where they differentiate themselves from their competitor in terms of product and serve that they offer. One of the most commonly adopted practice is to customize the product to suit to the ever changing dynamic needs of the customer. This is commonly referred as Product adaptation. There are several internal, external and performance related factors which affects the product adaptation of any product. It differs from

one industry to another industry which has its impact on the level of product adaptation. Product adaptation has five different level from pure standardization to pure customization (Lampel and Mintzberg, 1996). The product takes its own level depending on several factors including the type of industry it belongs. The research is carried among the Genset OEMs to study the product adaptation practices that they follow with the special emphasis on the different critical factors that influence product adaptation. Based on literature survey top three critical factors were

chose and studied to know their impact on the product adaptation practice in Genset industry.

II. LITERATURE REVIEW

There are enough literatures in the past that discussed the subject of product adaption which has emphasized its importance and factors which affects them. The factors can be broadly categorized into external, internal and performance. The details of the factors which affects product adaptation and its importance is discussed below

According to MacDuffie et al. (1996) Firms can not make strong bottom line in its balance sheet unless it customizes its products. As the customer tastes and preferences are changing rapidly, it is very much essential to meet the growing demand of the customers. Customers don't mind paying premium for the product if it is as per their requirement. This phenomenon is applicable for both institutional and individual customers. They also emphasized about Intermediary variety of products which is the most preferred choice of the customer in automobile industry. This intermediate variety is in between fundamental standard variety and peripheral customized variety. So the customer preference is always in the middle choice.

Squire et al. (2004) examined various types of customization with four manufacturing functions with special emphasis to distribution customization. The four manufacturing function includes distribution, assembly, fabrication and design customization. In distribution customization, the basic product design is not changed. Only items like packaging, delivery time and location is customized. In assembly customization, various standard assembly combinations are offered to the customer and the customers are made to choose from the offered options. In case of fabrication, the customers are given a choice to choose from the pre-defined design and the items are manufactured based on the order that customer place. Finally, in design

customization the customer inputs are collected starting from the beginning and incorporated in the design.

Lampel and Mintzberg (1996) reported that there are five levels of customization from pure standardization to pure customization. It was found that it is neither pure customization nor pure standardization that is preferred by many customers. Many customers prefer the middle ground where they look for customized standardization. In case of customized standardization or modularization, the basic components are standard whereas the assembly is customized. This type of customization is usually followed in automobile industry where the body is assembled with standard components.

Salvador et al. (2004) recommended two type of mass customization including soft and hard mass customization. Soft mass customization follows moderate level of customization with long distribution network and it employees make to stock (MTS) system. Hard mass customization follows high level of customization with short distribution network and it employees assemble to order (ATO) and make to order (MTO) system. The decision to choose soft or hard mass customization is based on Customer preference (i.e. marker requirement), product design and supply chain structure.

Krishnan and Ulrich (2001) emphasized that marketing, engineering and operation functions are essential function for product adapation where marketing function takes care of the product planning. Engineering function looks after the design related decision and operation function looks after supply chain.

These three functions play a crucial role in product adaptation.

According to Yeh and Chu (1991) Product varieties makes an important role in the customization and it is directly linked with the performance of the organization. Increase in the product variety increases the performance of the

organization. Customization through product variety increases the cost of the company especially the design and manufacturing cost. Hence the organization has to give due importance to the cost of manufacturing while deciding whether they have to customize or not.

According to Otero-Neira et al., (2010) introducing new products/modifying the existing product is the need of the hour as it makes the firm to remain competitive which can influence market share and profitability of the organisation. So it directly influences the customer demand and helps the firm to remain competitive.

A Study conducted by Piirainen et al. (2010), highlighted how the external environment affects a firm's product adaptation strategies. It was discovered that various factors political, social, and financial factors influenced the product adaptation. So like internal factors external factors play an equally important role in deciding to adapt the existing product.

In another related study of Meyer and Bernier (2010), a research was placed on a case study of an MNC called Agatha, investigating the factors that influence the choice of product adaptation and its consequence in marketing mix. They found that one of the fundamental intentions behind an adaptation methodology is the point at which a firm needs to be the pioneer of a market or connect new fragments of the market adaptation is vital. Different discoveries underlined that social contrasts on worldwide markets influence the adaptation of the item, cost and advancement. They likewise found that it has been a test for Agatha to discover a harmony between the level of normalization and adaptation of the various components of the advertising blend.

McKee and Konell (1993), in their study "Product Adaptability: Assessment and Strategy" concluded that product adaptability can complement and strengthen organizational

strategy. In conventional stable conditions, associations must accommodate their qualities with accessible outer assets so as to endure. They inferred that in a persistently evolving condition, associations themselves must be set up to constantly change.

Horska et al. (2007) found that products must differ more from the original, in several different ways, as the culture differs more. In their examination, by recommending that adaptation of item arrangement to national enactment and taste is likewise significant in all business sectors, they propose that the overall significance of adaptation would appear to lessen with the social separation.

Franke et al. (2009) in the research "Testing the Value of Customization: When Do Customers Really Prefer Products Tailored to Their Preferences?" discovered that the key supposition is that products customised according to the need of user creates higher benefits for them as they deliver most suitable customer benefits. The couple of studies conducted by these authors explained that the customised products also creates desire to pay among customers as the benefit gain is higher for them. Customers prefer to receive higher benefits if customers have better ability to express their preferences, better insight into their own preferences and Greater product involvement. The research concluded that customization has the potential to be a powerful marketing strategy if these conditions are met.

Piirainen & Seta (2008) in their research work in a Swedish company that offers medical equipment found that product adaptation is affected by external environmental factors. They studied the Chinese and German market related to the medical product. They came up with interesting findings that in China product adaptation of various marketing mix is affected by environmental factors. In case of German market, the product adaptation is affected by social, cultural, economic, legal and political factors.

III. SOFTWARE QUALITY CHALLENGE

In the software industry, the developers will never state that the product is free of imperfections, dissimilar to other modern item makers generally do. This distinction is because of the accompanying reasons.

Product Complexity

It is the quantity of operational modes the item allows. Regularly, a industrial item permits just not exactly a couple of thousand methods of activity with various blends of its machine settings. Be that as it may, software bundles permit a large number of operational conceivable outcomes. Thus, guaranteeing of all these operational conceivable outcomes accurately is a noteworthy test to the software industry.

Product Visibility

Since the industrial items are obvious, the greater part of its deformities can be identified during the manufacturing procedure. Likewise, the absence of a section in a industrial item can be effectively identified in the item. Be that as it may, the imperfections in programming items which are put away on diskettes or CDs are imperceptible.

Product Development and Production Process

In an industrial product, defects can be distinguished during the accompanying stages –

- **Product development** – in this stage, the originators and Quality Assurance (QA) staff checks and tests the item model to distinguish its faults.
- **Product production planning** – during this stage, the generation procedure and tools are planned and arranged. This stage additionally gives chances to investigate the item to distinguish the imperfections that went unnoticed during the development stage.

- **Manufacturing** – in this stage, QA methodology are applied to recognize detect failures of items themselves. Defects in the item distinguished in the primary time of assembling can as a rule be amended by an adjustment in the item's plan or materials or in the production tools, in a way that wipes out such imperfections in items made in future.

Be that as it may, on account of software, the main stage where defects can be identified is the development stage. If there should be an occurrence of software, product production planning and manufacturing phases are not required as the manufacturing of software copies and the printing of software manuals are conducted automatically. The variables influencing the detection of imperfections in software items versus other industrial items are appeared in the accompanying table. Be that as it may, on account of software, the main stage where defects can be identified is the development stage.

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IV. RESEARCH METHODOLOGY

Through literature review the different variables of interest has been identified. A total of top three factors which affects the product adaptation was finalized. An online survey was conducted among 266 Genset OEMs to capture these three factors that affects product adaptation. These Genset OEMs serve different parts of the country and outside the country. The details of the region that they serve is given in the table 1.

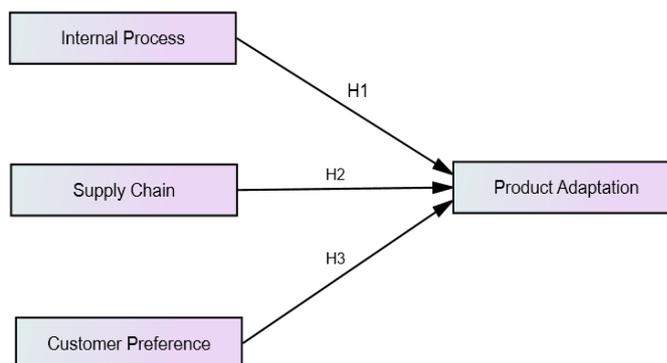
Table IV-1: Region Serving

| Region | Numbers |
|---------------------------|---------|
| West India | 28 |
| North India | 98 |
| South India | 14 |
| East India | 28 |
| All India | 28 |
| All India & Outside India | 70 |

V. DATA ANALYSIS

To study the various relationship and to prove the objective of the research work, three different hypotheses were framed and was tested using appropriate statistical techniques. The graphical representation of the relationship between variables and its hypothesis is given in Figure 1

Figure V-1: Relationship between Variables



H1: Effective internal processes significantly positively influence product adaptation practices.

H2: Effective Supply chain significantly positively influence Product adaptation in transnational organization

H3: Customer Preference for Product adaptation positively influence firms Orientation towards Product Adaptation of Genset

To test the hypothesis H1, H2 and H3 multiple linear regression was performed. Through multiple regression one can find the prediction of more than one Independent variable on dependent variable. The independent variables are referred as predictor variables whereas the dependent variable are referred as outcome variable.

To check the effectiveness of internal process, supply chain and customer preference for product adaptation on product adaptation multiple linear regression is used. Being a parametric test which assumes that the population from where the sample is drawn is normally distributed. Basic assumptions of parametric test is checked to see whether multiple linear regression can be applied or not.

As per Brace, Kemp and Snelgar (2006) to perform multiple linear regression, the data should meet the below assumption:

1. Continuity of dependent variable
2. Linearity
3. Normality
4. Homoscedasticity
5. No Multi collinearity
6. No Auto correlation
7. No outlier

5.1 Testing the assumptions of multiple linear regression

To test the above mentioned assumptions of multiple linear regression SPSS is used. Implementation of Product adaptation is considered as a dependent variable and Effective internal process, effective Supply chain and customer preferences are considered as independent variable.

The first and for most condition of multiple linear regression is the continuity of dependent variable i.e the dependent variable should be in ratio or ordinal scale. Here the dependent variable is product adaptation and it is measured by using 5 point likert scale from strongly disagree to strongly agree. Hence the data meets the first condition for multiple linear regression.

Secondly, there should be a linear relationship between independent variables and dependent variable. To test this assumption scatter plot is plotted between dependent variable –Y and independent variables X1, X2 and X3. The output of the plot is given below. The test results in Figure

2,3 and 4 shows that there is a straight line linear relationship between dependent variable and independent variables.

Figure V-2: Scatter Plot- Product adaptation(Y) and Internal Process(X1)

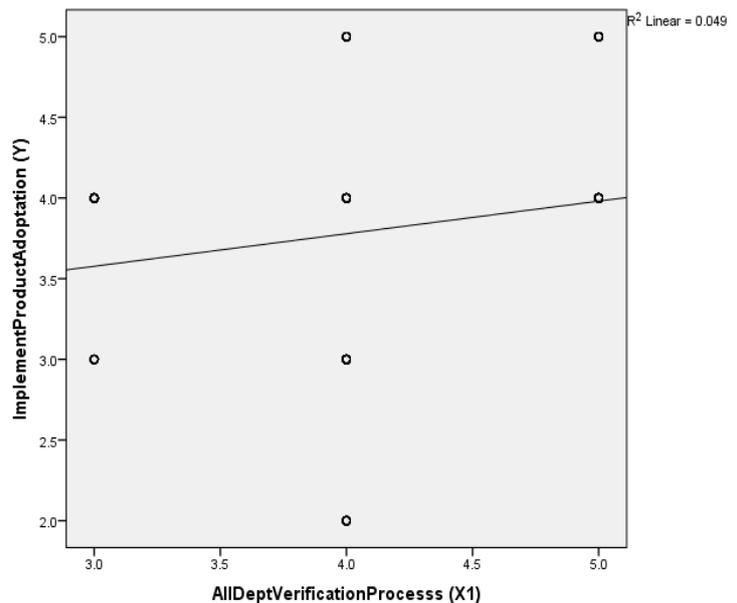


Figure V-3: Scatter Plot-Product adaptation(Y) and Supply Chain (X2)

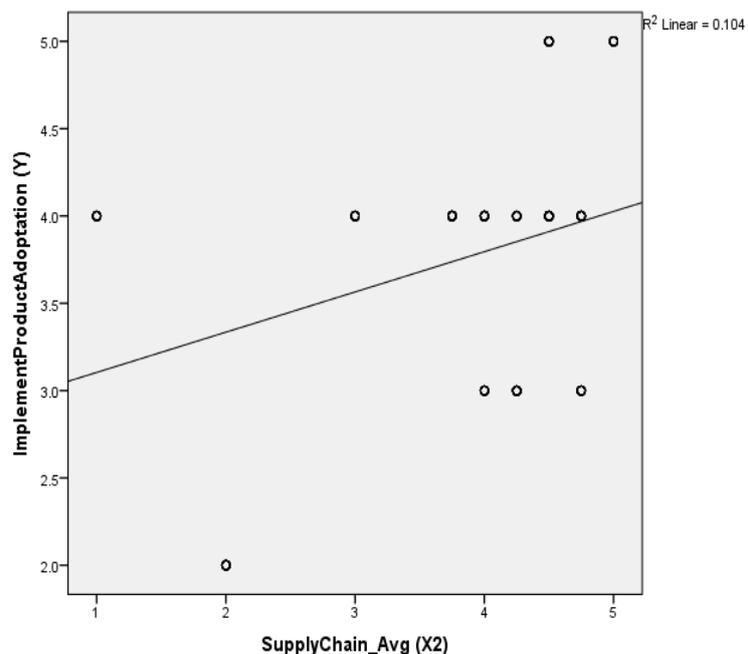


Figure V-4: Scatter Plot-Product adaptation(Y) and Customer Preference (X3)

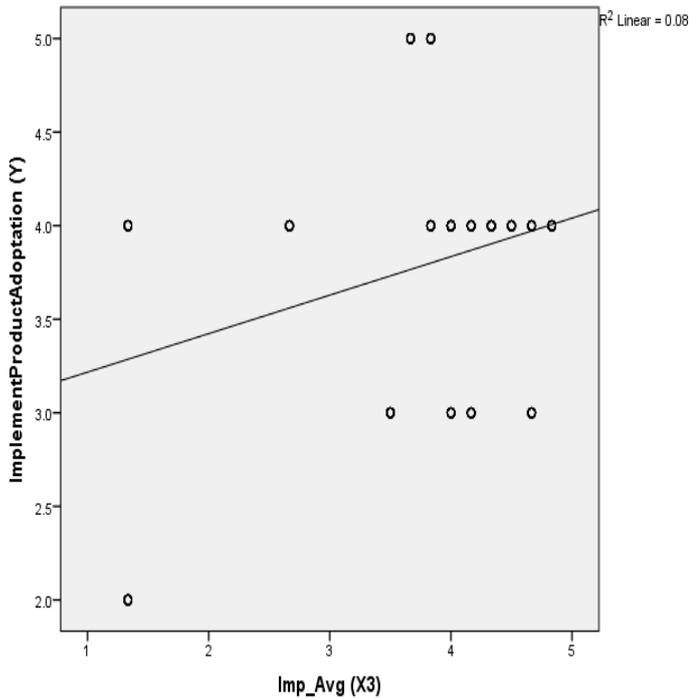
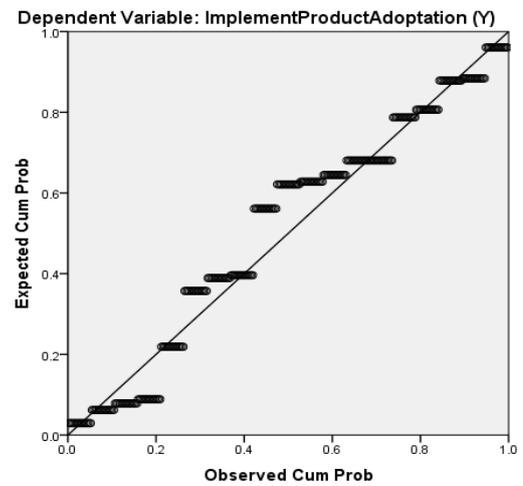


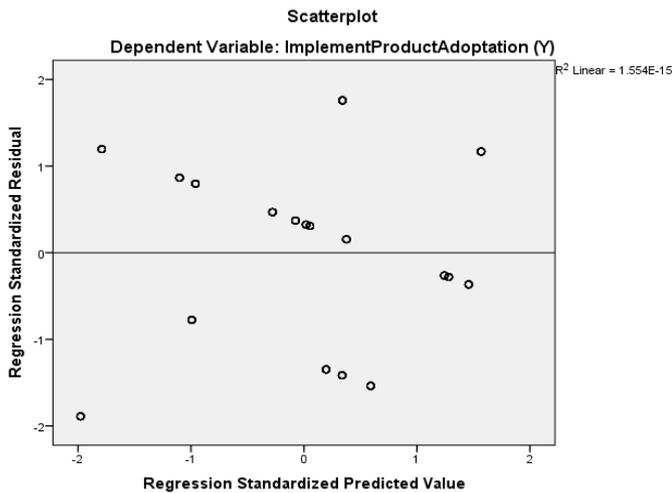
Figure V-5: Normal P-P Plot of Regression Standardised Residuals



Fourthly, the variances of the error terms are equal across the independent variables i.e. the variable across the line of best fit remains more or less similar as you move along the line. This phenomenon is referred as homoscedasticity. This can be checked by plotting the scatter plot between standardized residual and standardized predicted value. By examining the scatter plot of figure 6 , we observe that the variance of error terms are same across line. Hence we can conclude that the data fulfills the assumption of homoscedasticity.

Figure V-6: Scatter Plot- Regression Standardised residual and Predicted Value

Thirdly, the residuals of the regression should be normally distributed. The residual are nothing but the error terms or the difference between dependent variable and independent variables. To check the normality of the residuals, normal P-P plot is examined. The Normal P-P plot is plotted between expected cumulative probability plot and observed cumulative probability plot for the standardized residuals of the dependent variable Product adaptation. It is observed in our SPSS output of Figure 5 that the circle in the plot are meeting the diagonal line, which indicate that there is that the residuals are normally distributed.



| | | | | | | | |
|------------------------------------|------|------|------|-------|------|------|-------|
| Effectiveness of Supply chain (X2) | .217 | .080 | .304 | 2.726 | .007 | .248 | 4.027 |
| Customer preference (X3) | .165 | .078 | .289 | 2.890 | .038 | .245 | 4.081 |

Table V-3: Collinearity Diagnostics^a

| Model | Dimension | Eigenvalue | Condition Index | Variance Proportions | | | |
|-------|-----------|------------|-----------------|----------------------|--|------------------------------------|--------------------------|
| | | | | (Constant) | Effectiveness of internal process (X1) | Effectiveness of Supply chain (X2) | Customer preference (X3) |
| 1 | 1 | 3.902 | 1.000 | .00 | .00 | .00 | .00 |
| | 2 | .079 | 7.046 | .02 | .19 | .04 | .05 |
| | 3 | .012 | 18.369 | .98 | .80 | .04 | .02 |
| | 4 | .008 | 22.419 | .00 | .01 | .92 | .94 |

a. Dependent Variable: Product Adaptation (Y)

Fifthly, the independent variables should not show multicollinearity. It occurs, if the variables are highly correlated with each other. This can be checked by looking at the values of correlation matrix, tolerance or VIF. We have considered tolerance and VIF to come to the conclusion that whether the data is having multi collinearity issue or not. The value of VIF should not be above 10 or the value of tolerance should not be less than 0.2 to confirm that the data does not have any issue of multi collinearity (Hair et al., 1995). After running SPSS, the output is given in the table 2. None of the Tolerance values are less than 0.2 or VIF values are above 10. Hence we can confirm that there are no issues of multi collinearity in our data.

Table V-2: Collinearity Statistics

| Model | Unstandardized Coefficients | Std. Error | t | Sig. | Collinearity Statistics | | |
|-------|--|------------|------|-------|-------------------------|------------|------------|
| | | | | | B | Std. Error | Tol |
| 1 | (Constant) | 1.574 | .297 | 5.308 | .000 | | |
| 1 | Effectiveness of internal process (X1) | .274 | .052 | .300 | 5.252 | .000 | .950 1.053 |

Sixthly, there should be independence of observation or the data should not be auto correlated. For that we need to check whether the values of the residuals are independent to each other or not. It can be tested by running Durbin Watson test. The output of the test result is shown below. The Durbin Watson value between 1 and 3 indicate that there is no auto correlation. We need to concern in case if the Durbin Watson value is under 1 or more than 3 (Field, 2009). The obtained SPSS output of Durbin Watson is given below, which shows 1.534, indicating that there is no auto correlation. So there is independence of observation.

Table V-4: Durbin-Watson

| R | R Square | Adjusted R Square | Std. Error | Durbin-Watson |
|-------------------|----------|-------------------|------------|---------------|
| .436 ^a | .190 | .160 | .630 | 1.534 |

a. Predictors: (Constant), Effectiveness of internal process chain(X2) & Customer Preference (X3)

b. Dependent Variable: Product Adaptation (Y)

Seventhly, there should not be any outlier in the data. If there is any potential outlier it might create problem in the data analysis and many times the data may not be normal due to more number of outliers. So it is advisable to delete the outliers provided, it does not contradict with the objective of our research. To identify the potential outlier, Mahalanobis and cook’s distances are checked. If the Mahalanobis distance is above 7 or cook’s distance is above 1, then we can consider the case as potential outlier and needs to be filtered for further analysis (Tabachnick&Fidell, 2001). The output of mahalanobis distance and cook’s distance are given. Since none of the values of mahalanobis distance is above 10 or the cook’s distance is above 1, we can conclude that the data is free from outliers.

TableV-5: Residual Statistics^a

| | Minimum | Maximum | Mean | Std. Deviation | N |
|----------------------|---------|---------|------|----------------|-----|
| Predicted Value | 3.19 | 4.26 | 3.79 | .303 | 266 |
| Std. Predicted Value | -1.978 | 1.568 | .000 | 1.000 | 266 |

| | | | | | |
|-----------------------------------|--------|-------|-------|-------|-----|
| Standard Error of Predicted Value | .040 | .127 | .074 | .024 | 266 |
| Adjusted Predicted Value | 3.22 | 4.24 | 3.79 | .302 | 266 |
| Residual | -1.190 | 1.107 | .000 | .626 | 266 |
| Std. Residual | -1.890 | 1.759 | .000 | .994 | 266 |
| Stud. Residual | -1.919 | 1.765 | .001 | 1.003 | 266 |
| Deleted Residual | -1.227 | 1.116 | .001 | .637 | 266 |
| Stud. Deleted Residual | -1.929 | 1.772 | .000 | 1.005 | 266 |
| Mahal. Distance | .082 | 9.836 | 2.989 | 2.581 | 266 |
| Cook's Distance | .000 | .029 | .004 | .007 | 266 |
| Centered Leverage Value | .000 | .037 | .011 | .010 | 266 |

a. Dependent Variable: Product Adaptation (Y)

After checking all the seven assumptions of multiple linear regression it was found that the data does not violates any of the assumptions, so we can apply multiple linear regression for our data. The dependent variable-Implementation of product adaptation was taken as dependent variable in SPSS and the independent variables-effectiveness of internal process, supply chain and the customer preference for product adaptation are considered as independent variable in SPSS. The output of SPSS is given below

The model summary table given in the below. This tables provides the details on how the regression model fits the data. The table provides details like R, R², adjusted R² and error term.

Table V-6:Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|-------|-------------------|----------|-------------------|----------------------------|---------------|
| 1 | .436 ^a | .190 | .180 | .630 | 1.534 |

- a. Predictors: (Constant), Effectiveness of internal process(X1), Supply chain(X2) & Customer Preference (X3)
b. Dependent Variable: Product Adaptation (Y)

The R in the above table indicate the correlation coefficient between independent variables and dependent variable. It provides the quality of predication of the dependent Variable. We have obtained R as 0.436. R² is the square of R which indicate the percentage of dependent variable explained by independent variable. The R square in the table reads as 0.190. We need to consider it as 19% which represents that 19% of the variation of the dependent variable is explained by the independent variable. As we keep adding the independent variable the value of R² increases to have a cap on it, we have adjusted R². The adjusted R² for the data is 18% and it indicates that 18% of variation in the data is explained by the independent variable.

The next table for our consideration is ANOVA table. It shows how well the regression model fits the data. In the below table, we can conclude that the all independent variables significantly predicts the dependent variable as the level of significant is 0.000 which is below 0.05 in our case. Hence we can summaries the overall regression model is the good fit for our research data.

TableV-7: ANOVA

| Model | Sum of Squares | df | Mean Square | F | Sig. | |
|-------|----------------|---------|-------------|-------|--------|-------------------|
| 1 | Regression | 24.323 | 3 | 8.108 | 20.447 | .000 ^b |
| | Residual | 103.888 | 262 | .397 | | |
| | Total | 128.211 | 265 | | | |

- a. Dependent Variable: Product Adaptation (Y)
b. Predictors: (Constant), Effectiveness of internal process(X1), Supply chain(X2) & Customer Preference (X3)

To test whether the individual independent variables are statistically significant or not for predicting the dependent variable, coefficient table is examined. The independent variables X1 and X2 are significantly related with the dependent variables as the significant values are less than 0.05 whereas X3 is not significantly related with the dependent variables the significance value is 0.430 which is above 0.05.

TableV-8:Unstandardised/Standardised Coefficients

| Model | Unstandardised Coefficients | | StdCoeff | t | Sig. | Collinearity Statistics | | |
|-------|--|----------|----------|------|-------|-------------------------|------|-------|
| | B | Std. Err | Beta | | | Tol | VIF | |
| 1 | (Constant) | 1.574 | .297 | | 5.308 | .000 | | |
| | Effectiveness of internal process (X1) | .274 | .052 | .300 | 5.252 | .000 | .950 | 1.053 |
| | Effectiveness of Supply chain (X2) | .217 | .080 | .304 | 2.726 | .007 | .248 | 4.027 |

| | | | | | | | |
|--------------------------|------|------|------|-------|------|------|-------|
| Customer preference (X3) | .165 | .078 | .289 | 2.890 | .038 | .245 | 4.081 |
|--------------------------|------|------|------|-------|------|------|-------|

From the above coefficient table, mathematically the equation for the unstandardized estimates can be represented as

$$Y = 1.574 + 0.274X_1 + 0.217X_2 + 0.165X_3$$

Where Y = Implementation of Production adaptation

X1 = Effectiveness of internal process

X2 = Effectiveness of supply chain

X3 = Customer preference for product adaptation

If the effectiveness of internal process (X1) increases by 1 Implementation of product adaptation (Y) increases by 0.274

If the effectiveness of supply chain (X2) increases by 1 Implementation of product adaptation (Y) increases by 0.217

If the Customer preference for product adaptation (X3) increases by 1 Implementation of product adaptation (Y) increases by 0.165

Through multiple linear regression it was found that effectiveness of internal process, effectiveness of supply chain and Customer preference for product adaptation is statistically significant influence Product adaptation practice in the organization. Hence the first three hypothesis H1, H2 and H3 has been proved.

VI. MANAGERIAL IMPLICATION AND CONCLUSION

Though Product adaptation is need of the hour, several literatures has highlighted that it involves considerable cost to the company due to its design, manufacturing and supply chain modifications (Yeh and Chu, 1991). Moreover, as the product adaptation has five different level from pure standardization to pure customization (Lampel and Mintzberg, 1996). It has to be decided what level customization has to offer the customer. The finding of the study concludes that internal process of the organization, Supply chain capabilities and customer preference are the important variables that significantly affects Product adaptation. Hence manufacturer needs to decide the level of product adaptation for their product by giving due importance to the critical factors so that they know their internal capabilities to control the cost of manufacturing and to remain profitable in the business.

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