# Automation of Supplier Price Evaluation Report in MS Excel by Using Visual Basic for Applications: A Case of Footwear Industry

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*Abstract*-Automated systems have always been time conserving as well as effective particularly in the digital job. In the different industrial fields, staff members are worked with to prepare the reports for top monitoring for the analysis of different parameters of company. Since, the manual labor requires time as well as there is the higher opportunity of error in it. In that circumstance, in order to lessen the non-value additional time and also increase the accuracy, automation is supremely thought about. This report was automated in order to decrease the none-value added reporting time and to lessen the duplicated reporting errors. All the manual actions of the report were gotten to be known by the writers and they were equated by the help of visual standard for applications (VBA) in excel. The code was written and also carried out in the form of macros called at the back end of command buttons affixed on the userform. Time study prior to and after automation of the report was conducted to disclose the effectiveness of the automated technique. The comparison of total time of making the report showed that the automated technique took 88.56% less time in the comparison of old (hands-on) approach of making supplier rate analysis report. The system of automated report development can be included in Microsoft Dynamics AX 2012 which is already implemented there; therefore writers of this paper recommend that it needs to be applied in AX ERP since succeed automation is not the irreversible remedy.

*Keywords*-*Automation, Visual Basic For Applications (VBA), Macro, Vendor, MS Excel, Rate.*

## I. INTRODUCTION

Purchase together with buying is among the primary procedures of supply chain [1]. Crucial part of the last cost of any type of product is identified by the purchase expense; this is because, lasting firm's visibility is figured out by the option of suppliers [2]. Nowadays, in such a related also affordable business environment, organizations are handling the reliable decision making in the context of business associate's choice [3].

Many global enterprises have boosted their level of outsourcing together with started to count a lot more on their supply chain network as a foundation of competitive advantage [4]. The difference of the brand-new strategies is to use a plan of using a solitary supplier (or a few), for a fairly long term, with agreement of continual improvement and to preserve this interrelation as long as there are not a problem in the interrelation with the distributor [2]. The study showed that quality also price variables for supplier evaluation are trivial. The shipment together with distributor relationship administration have substantial impact on examination of the vendor. The research also illustrated that supplier examination has significant influence on process renovation [5]. Suppliers are important to getting firms not only in monetary terms but additionally to an increasing level, they provide consumers with access to innovations [6]. Provider performance has hence significant effect on the performance also efficiency of their customers [7]. Gradually a variety of complementary measurements have been proposed, yet in practice most of provider analyses comprised simply 3 aspects: price/cost, quality, also shipment [3], [7].

Visual Basic for Application VBA is the Microsoft's programming language utilized in MS excel for the automating process of hands-on operation. In excel it carries out calculations with 100% accuracy in less time. [8]. Typically VBA can be utilized for mathematical calculations like making variables, dealing with diverse equations and creating outcomes [9][10]. It is also called a macro programming. Macro is the group of directions by help of which facility user determined operations are automated in MS office atmosphere [11]. When VBA in MS workplace is used to program applications, it involves no or very little price. Furthermore, accuracy in complex analysis likewise enhances. In fact much less experienced worker can trigger such applications together with can get accurate outcomes with increased performance [12]. After macros are configured in excel they can be run just in one click of the button.By making use of VBA user can launch user-defined functions also automate all spreadsheet jobs. [13]. As compared to spread sheet atmosphere together

with excel formulae Visual basic editor (VB) together with VBA are various [13]. The benefits of VBA in excel are automates repetitive and routine tasks, access to various other individuals, lowers the turn-around time, decreases the formulas concern made use of in excel reports secures workbook and conceal worksheets. [9]. Microsoft has actually provided the feature of VBA into its various workplace applications that is word, excel, access and also PowerPoint. In the commercial world, Microsoft excel is categorized as one of the most appropriate application as the well worth for spread sheets together with at the mean time the application of VBA can likewise be made use of in the rooted [14]. Existing research paper offers the automation of product distribution time analysis report by using VBA in excel. Below by the management of ABC Shoes Organization believed to automate some of workplace operate in MS excel due to substantial workload of manual work at the purchasing department of ABC Shoes Organization. In this regard additional time will certainly be given to workers for relaxation together with learning other activities. At the mean time the blunders were additionally concentrated to be decreased from the calculations of the report. With respect to that product shipment time analysis report was automated by using VBA in excel.

## II. LITERATURE REVIEW

On the subject of automated reporting, number of researchers have published their work and some of those works are presented under this heading. Zainal Abidin et al., (2015) performed a study with the goal of making an application to determine Water Quality Index (WQI) and also Air Pollutant Index (API) by the use of VBA in MS Excel. The application was readied to calculate straight the indices. The needed formulae were converted into the code. Moreover, description of each of the index was programed; to make sure that details of measured index worth could be shown efficiently in addition to it [8]. Ahmadi et al., (2018) conducted study for the application of the CTR Milk model by the use VBA in excel. CTR milk is referred to as the vibrant simulation version for grazing breast feeding milk cows which is used for the prediction of manufacturing of milk and revenues based on the different specifications i.e. ruminal food digestion and the absorption of nutrients under periodic timetables of feeding. Because of the discontinuation of SMART software as well as non-availability of its clients; the CTR milk version was translated right into excel VBA in order to convert the input into outcome. By the assistance of this study, it was offered to the wide series of dairy farmers, dairy nutrition experts, expansion experts and also scientists [15]. Junior et al., (2011) established the brand-new application for the results of post-processing the Reactor Tour as well as Drip Analysis Program 5 (RELAP5) by using excel VBA. It showed to be rather helpful tool to speed up the output information evaluation [16]. Rushit Hila (2009) programed (in VBA Excel) the application for the identification of outliers in the information and arrangement of data conveniently. In the application, number of actions were automated for cleansing and verifying data before importing it into MS access (utilized as a database) [17]. Cirujano and also Zhu (2013) established a new technique for

automatic production of manpower planning report by the use VBA excel. Based on new technique, duties as well as routines of the engineers in different tasks were accumulated. The accumulated information was assembled, examined and also arranged. Hereof the engineer's information in numerous tasks could be recovered and the future plans for the engineers could be made. The technique was verified in the consulting company with more than hundred workers. It was shown that guy power planning report could be produced automatically; whereby incredible amount time and cost will certainly be conserved [14]. Sato and Yokoyama (2001) created an application by utilizing VBA in excel for transfer of an image information from the data readied to a worksheet on click of Web-icon [18]. Lessa et al., (2016) automated a practical mathematical design for computation of packaging and the logic program by using aesthetic standard for application (VBA) in excel. The visuals styles were conveniently developed for just how the packages are being filled [19]. H. Evenson (2014) carried out tool communication in excel by utilizing VBA for the first time in 2014 [20]. Donald E. Blattner as well as Valrico, FL (2007) developed an automated report generation system by using VBA in MS task. The invented system, permitted customer to pick, format filter and also type the report by the assistance discussion box showed up on the display [21]. Wettlaufer (2010) executed mapping rules in the form of VBA macros in excel. For each and every report, one macro was designed. Anticipated values were created by the macros in the separate spreadsheet i.e. expected values spreadsheet. Then it sends the patients follow-up to the merline.net web server for processing the data and processed client follow-up session was generated had of reports bundle in the winrar documents [22]. Norton and also Tiwari (2013) made use of VBA for the growth of code for making design enrollees understand the evaluation of unique freezing technology [10]. Bartoszewicz as well as Wdowicz (2019) recommended a new technique for the analysis of production procedure, its visualization as well as automation was consisted on the assimilation of manufacturing planning module of SAP enterprise resource planning (ERP) with excel worksheet and VBA. The brand-new process for information movement as well as evaluation was revamped and also implemented; which was more adaptable and also faster and by the assistance of which whole process of intricate rational report was quicken (operation time decreased from 2 hours to 5 minutes) [23]. Harahap as well as Azmi (2017) carried out a research with the goal to establish the application by the use VBA excel which could make the small degree rain conveyance system by using rational technique as offered in MSMA 2 [24]. Yan and Wan (2017) created an application by the use of excel VBA for an automated computation and also generation of bill of material (BOM) of transmission line. Efficiency as well as precision are substantially improved by the style and application of the layout as well as errors in the process of making overall steel BOM were minimized [25]. Kalwar as well as Khan (2020) automated procurement as well as purchase order report at shoes sector; after automation, the procurement report used to take 516.578 2nd to be completed rather than 2076.751 seconds. In addition, purchase order took 2-3 secs instead of 15-20 mins after automation [26]. Chaudhry A. K et al. 2021 improved the efficiency of small management information

system by using VBA in MS Excel; they developed a demand management system at logistic center south, civil aviation authority (CAA) Karachi in which routine demands were put and retrieved when needed. Comparison of performance of both old and new system revealed that 50% of employee`s time was saved [27].

## III. PROBLEM STATEMENT

Footwear sector is proliferating worldwide [28], [29] but in the context of electronic automation, it lags behind. The use of newest technology causes the increased efficiency, efficiency as well as expense effectiveness [30]. In this period of artificial intelligence and also expert system, still in tiny and also moderate enterprises, reports with vital as well as sensitive calculations are prepared in MS succeed manually. Because of hand-operated operation, the possibility of mistakes in the computation is higher; on the very same time, dealing with those errors is time consuming task which adds no worth, while doing so. In the planning and also costing department of ABC Footwear Company, preparation of order costing and also article order costing reports was a time consuming job and also the chance of the mistakes was greater as well. For that reason, it was chosen to set their manual operation in MS by the assistance of aesthetic fundamental for applications (VBA). After the automation of mentioned reports, the non-value extra time which was made use of to be used up on the prep work of reports will certainly be conserved. Most importantly, the reports produced from the programed spread sheet will be error free.

## IV. RESEARCH GAP

Tremendous amount to work has been done on making use of VBA as well as numerous researchers have actually utilized this for number of problems in excel, word, MS task and Auto-CAD. It was never been utilized for the report automation in MS excel. In the present research, it was utilized for the automation as though individual needs to do only couple of clicks to complete the report in few seconds. Research space of present research study is enough to be reflected from the here and now VBA code and also function of report automation.

## V. AIMS AND OBJECTIVES

Aim of the present research was to minimize the overall reporting time and to reduce errors in the report and it was achieved by the objective of automating the vendor rate analysis report by using visual basic for applications in MS Excel.

## VI. RESEARCH METHODOLOGY

Research approach is the summary of techniques has actually been used for conducting research. Under this heading, details collection, details analysis, tools utilized for the report automation and method of calculations were talked about thoroughly listed below given headings.

### A. Data Collection

The details used in the present research was significant in nature as well as was accumulated from the person that was meant to make this report in excel. Details included the summary of various activities needed to make the report. The time study (sec) for the each of the hands-on task done for the making the report was performed by utilizing stop watch. 10 observations of time for the each of the hand-operated activity were taken. After the report was automated, the once more time study of the programmed execution of the report was additionally performed to ensure that both of the techniques could be compared in regards to time-effectiveness. In addition, clipping devices in MS windows was utilized for taking the breaks of various manual and automated actions of the report.

### B. Data Analysis

After the data was entered into MS excel, it was formed in the form of tables, average time of each task prior to and after automation was computed. The efficiency of both methods was compared by making the formulas (determining complete time of report development).

### C. Automation Tool

At the very first, authors learned the manual means the report was made and all those manual actions were translated right into the code of visual basic for applications (VBA) in MS excel. By the help of VBA vendor analysis report was entirely automated as well as the code was compiled and also executed in the visual basic editor of MS excel. The code was split into small parts in the form of macros and all those macros were called behind the command buttons attached on the userform. User simply required to click the key as well as the command was made use of to be performed.

Macro program included using embedded if statements. When If statement is used in the program, it looks for the values if they please the defined criteria, preferred result is returned as well as in case the condition is not real after that an additional result is returned [12]. When there greater than one conditions on the analysis of situation, set of drivers utilized because situation i.e. combination (As well as), disjunction (or) and negation (Not) [31]. When if statement is required to be used on the whole data, after that there would certainly be the use of something which can consistently use that condition on each of the item individually. For such circumstance, looping method is made use of. Loop is utilized to duplicate the block of code variety of times [32]. In the automation of present report, nested if conditions were used in loops so that they could be applied on the whole data. Primarily, for-next loop were utilized in the programing.

### D. Method of Calculations

There were different indices and parameters which were used for formulating the equations are presented as under.

#### 1) Indices
i=It refers to the items

j=It refers to the warehouse

k=It refers to the present year

*2) Parameters*

$TQ_k$= Sum of the quantity of item $i$ of warehouse $j$ purchased in the year $k$

$TQ_{k-1}$ =Sum of the quantity of item i of warehouse j purchased in the year k-1

$TQ_{k-2}$ =Sum of the quantity of item i of warehouse j purchased in the year k-2

Q= Quantity of items

C=Financial cost of items

FC$_k$=Financial cost of item i of warehouse j purchased in year k

$FC_{k-1}$=Financial cost of item i of warehouse j purchased in year k-1

$FC_{k-2}$=Financial cost of item i of warehouse j purchased in year k-2

$AV_k$=Average value of item i of warehouse j purchased in the year k

$AV_{k-1}$=Average value of item i of warehouse j purchased in the year k-1

$AV_{k-2}$=Average value of item i of warehouse j purchased in the year k-2

$QPv_{k-2 \wedge k-1}$ =Quantity percentage variance of item i from warehouse j purchased in year k-2 and k-1

$QPv_{k-1 \wedge k}$ =Quantity percentage variance of item i from warehouse j purchased in year k-1 and k

$ACPv_{k-2 \wedge k-1}$ =Average cost percentage variance of item i from warehouse j purchased in year k-2 and k-1

$ACPv_{k-1 \wedge k}$=Average cost percentage variance of item i from warehouse j purchased in year k-1 and k

*3) Formulae and Equations*

Different steps of calculations which were carried out during the repot formation were translated into mathematical formulae presented in the below given equations. The purpose of this report was to analyze the prices of different items purchased from different vendors across three years. Purchase department had the list of items procured by each of the vendor and the manager used to decide to work with the present vendors or not and the decision was to be based on the results of the report. Total quantity of the item $i$ from warehouse $j$ which was purchased in year $k$ was used to be calculated by the help of (1).

$$TQ_k = \sum_{k-1}^{K} \sum_{j=1}^{J} \sum_{i=1}^{I} Q_{ijk} \, \forall \begin{cases} i = 1,2,3, \dots, I \\ j = 1,2,3, \dots, J \\ Q > 0 \end{cases} \qquad (1)$$

Total quantity of the item $i$ from warehouse $j$ which was purchased in the year $k-1$ and $k-2$ were used to be calculated by equation (2) and (3) respectively.

$$TQ_{k-1} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} Q_{ijk-1} \qquad (2)$$

$$TQ_{k-2} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} Q_{ijk-2} \qquad (3)$$

Total financial cost of item $i$ of warehouse $j$ which is purchase in year $k$, $k-1$ and $k-2$ were used to be calculated by the help of (4), (5) and (6) respectively.

$$FC_k = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} C_{ijk} \, \forall \, C \geq 0 \qquad (4)$$

$$FC_{k-1} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} C_{ijk-1} \qquad (5)$$

$$FC_{k-2} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} C_{ijk-2} \qquad (6)$$

Equations (7), (8) and (9) were used for the calculation of average value of item $i$ of warehouse $j$ and purchased in year $k$, $k-1$ and $k-2$ respectively.

$$AV_k = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{C_{ijk}}{Q_{ijk}} \right) \qquad (7)$$

$$AV_{k-1} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{C_{ijk-1}}{Q_{ijk-1}} \right) \qquad (8)$$

$$AV_{k-2} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{C_{ijk-2}}{Q_{ijk-2}} \right) \qquad (9)$$

By the help of equations (10) and (11) were used for the calculation of quantity percentage variance of item $i$ of warehouse $j$ which was purchased in the year $k-2$, $k-1$ and $k-l$, $k$ respectively.

$$QPv_{k-2 \wedge k-1} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{Q_{ijk-1}}{Q_{ijk-2}} - 1 \right) \qquad (10)$$

$$QPv_{k-1 \wedge k} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{Q_{ijk}}{Q_{ijk-1}} - 1 \right) \qquad (11)$$

By the help of equations (12) and (13) were used for the calculation of average cost percentage variance of item $i$ of warehouse $j$ which was purchased in the year $k-2$, $k-1$ and $k-l$, $k$ respectively.

$$ACPv_{k-2 \wedge k-1} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{Q_{ijk-2} C_{ijk-1} - Q_{ijk-1} C_{ijk-2}}{Q_{ijk-1} C_{ijk-2}} \right) \quad (12)$$

$$ACPv_{k-1 \wedge k} = \sum_k \sum_{j=1}^{J} \sum_{i=1}^{I} \left( \frac{Q_{ijk-1} C_{ijk} - Q_{ijk} C_{ijk-1}}{Q_{ijk} C_{ijk-1}} \right) \qquad (13)$$

## VII. EXISTING METHOD OF MAKING REPORT

Existing method was a set of manual tasks used to be performed in MS excel. When the small tasks which are used to be performed on routinely basis, the cause mental fatigue and which cause errors and mistakes. In order to reduce those mistakes, the report was intended to be automated.

*A. Basic Data*

Needed data for the preparation of vendor rate analysis report was used to be downloaded from Microsoft Dynamics AX in excel (basic data). Basic data along with all the fields are presented in the fig.1 shown below.

Figure 1. Basic data for the preparation of material delivery analysis report

Authors of the present research paper, collected the time study of each of the manual activities (small/big) which was supposed to be performed for making the report. All the activities can be seen in figure 2 as presented below.
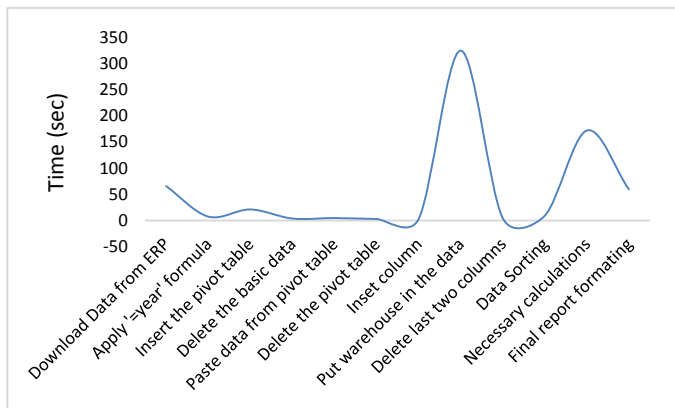


Figure 2. Time study of various activities which were used to be performed for making report manually

After totaling up the times of all manual activities, it was indicated that the user took 680 sec (11.33 min) to make the report.

## VIII. AUTOMATED METHOD FOR MAKING REPORT

Suggested method is the automation of all the manual tasks which were used to be performed by the operator to prepare the report. This automation was made possible by the help of visual basic for applications in excel.

### A. Designed Interface for Execution of Macros

Interface of the report which is basically a userform (see fig.3) that has been used for the execution of various macros on the click of command buttons as can be seen in the fig.3.
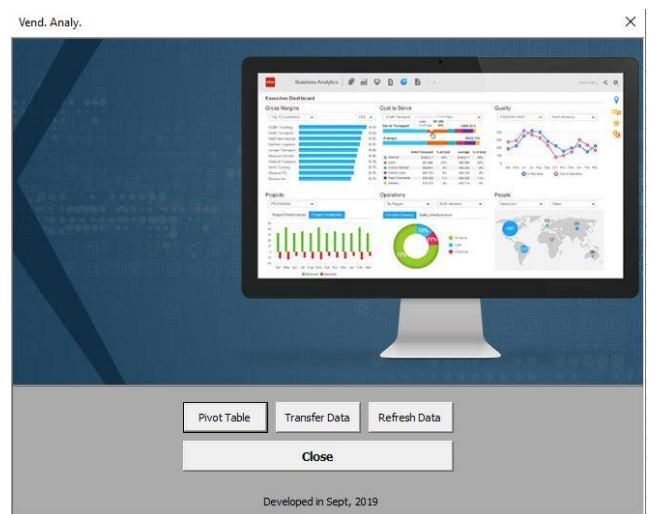


Figure 3. Userform designed for execution of macros

All macros at the back of command buttons are presented in the fig.4.
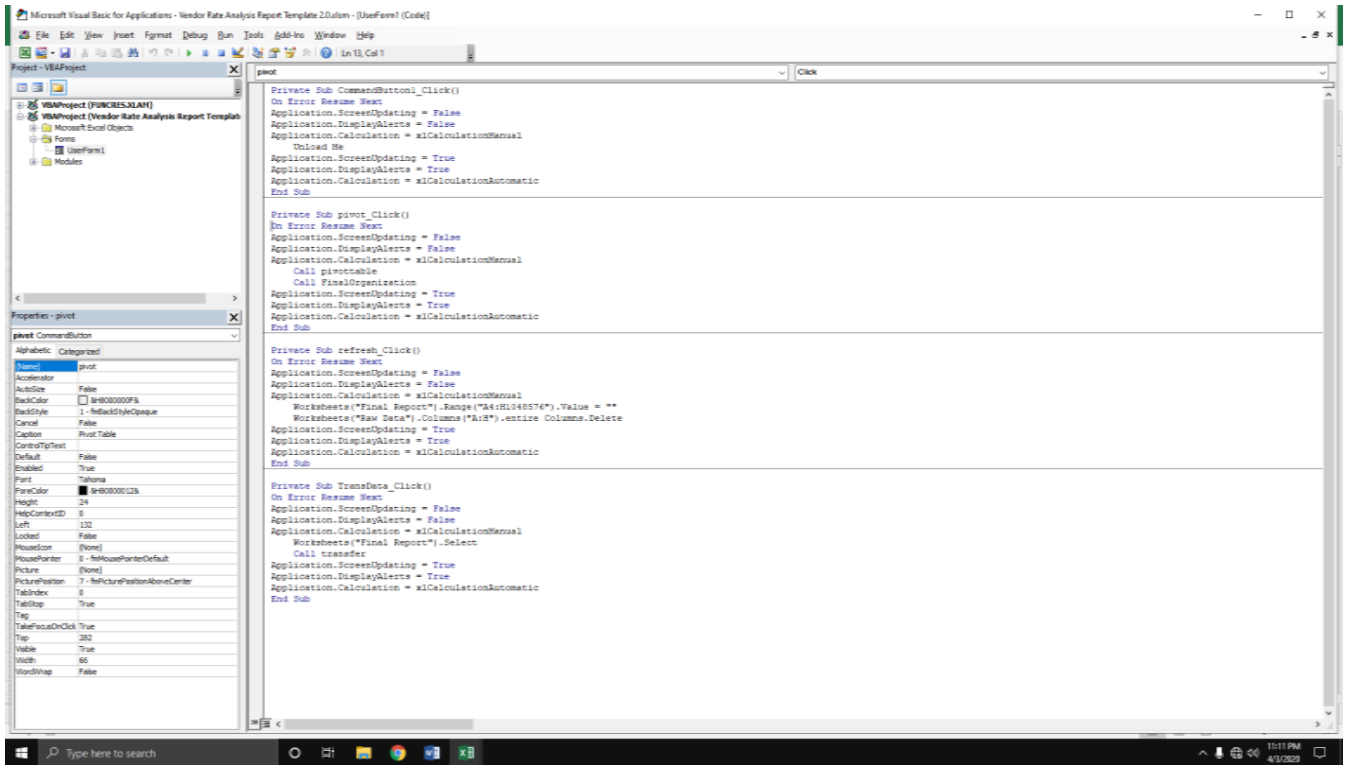
Figure 4.   Macros behind each of the command button of the userform presented in fig.2

## B. Needed Worksheets

In the template with the feature of automation, worksheet needed only two worksheets for the preparation of the vendor rate analysis report. Initially, data is processed into the 'Raw Data' worksheet by the help of various macros and in last, whole data is transferred to 'Final Report' by the help of for loop.



Figure 5.   Needed worksheets for the automated material delivery analysis report

## C. Macros Behind Command Buttons

Macros, which were programed to for the automation of all the manual tasks in excel are described in detail in below given headings.

### 1) Refresh Data

After the template is opened with the intention of preparing the vendor rate analysis report, contents from both the worksheets i.e. 'Raw Data' and 'Final Report' are cleared so as to prepare the new report. The code given below was used to clear the contents from both sheets.

```
Private Sub refresh_Click()
On Error Resume Next
Application.ScreenUpdating = False
```

```
Worksheets("Final Report").Range("A4:H1048576").Value
= ""
    Worksheets("Raw Data").Columns("A:H").entire
Columns.Delete
Application.ScreenUpdating = True
    End Sub
```

### 2) Insert Pivot Table

After the data is downloaded into the MS excel from Microsoft Dynamics AX, in last column i.e. Q '=year' formula is applied (see fig.2). Whole data is converted into the pivot table afterwards. Data from the pivot table and pivot table is deleted which can be seen in the fig.6.

```
Sub pivottable()
On Error Resume Next
Application.ScreenUpdating = False
rowscount = Worksheets("Raw Data").Cells(Rows.Count,
1).End(xlUp).Row
ActiveWorkbook.PivotCaches.Create(SourceType:=xlDatabas
e, SourceData:=Worksheets("Raw Data").Range(Cells(1, 1),
Cells(rowscount, 17)),
Version:=xlPivotTableVersion15).CreatePivotTable
TableDestination:=Worksheets("Raw Data").Range("R1"),
TableName:="PivotTable4",
DefaultVersion:=xlPivotTableVersion15
    With
ActiveSheet.PivotTables("PivotTable4").PivotFields("Wareho
use")
        .Orientation = xlRowField
```

```
    .Position = 1
  End With
  With
ActiveSheet.PivotTables("PivotTable4").PivotFields("Item")
    .Orientation = xlRowField
    .Position = 2
  End With
ActiveSheet.PivotTables("PivotTable4").AddDataField
ActiveSheet.PivotTables("PivotTable4").PivotFields("Quantit
y"), "Sum of Quantity", xlSum
ActiveSheet.PivotTables("PivotTable4").AddDataField
ActiveSheet.PivotTables("PivotTable4").PivotFields("Financi
al cost amount"), "Sum of Financial Cost Amount", xlSum
  With
ActiveSheet.PivotTables("PivotTable4").PivotFields("Year")
    .Orientation = xlColumnField
    .Position = 2
  End With
    ActiveWorkbook.ShowPivotTableFieldList = False

With Worksheets("Raw Data")
```

```
    .Columns("A:Q").EntireColumn.Delete
  End With
rowscount = Worksheets("Raw Data").Cells(Rows.Count,
1).End(xlUp).Row
colcount = Worksheets("Raw Data").Cells(2,
Columns.Count).End(xlToLeft).Column
'MsgBox (rowscount)
    With Worksheets("Raw Data")
      .Range(Cells(2, 1), Cells(rowscount, colcount)).Copy
      .Cells(1, colcount + 1).Select
      .Paste
    End With
rowscount = Worksheets("Raw Data").Cells(Rows.Count,
1).End(xlUp).Row
    With Worksheets("Raw Data")
      .Rows(rowscount).EntireRow.Delete
      .Columns("A:I").EntireColumn.Delete
    End With
Application.ScreenUpdating = True
  End Sub
```



Figure 6.   Result of above given code

### 3)  Organize Data

Code just given was used to inset the first column in order to put the warehouse. By the help of two for loops (executed as much as the number of rows in 'Raw Data' worksheet) warehouse of each of the item is put against it.

Sub FinalOrganization()

```
Application.ScreenUpdating = False
On Error Resume Next
Dim rowscount As Long
Dim colcount As Integer
With Worksheets("Raw Data")
    .Columns("A").Insert
```

```
  .Cells(1, 1).Value = "Warehouse"
  rowscount =.Cells(Rows.Count, 2).End(xlUp).Row
  colcount =.Cells(3, Columns.Count).End(xlToLeft).Column
End With
Row = 3
  For i = 1 To rowscount
    If Worksheets("Raw Data").Cells(Row, 2).Font.Bold =
True Then
        With Worksheets("Raw Data")
          .Cells(Row, 2).Offset(1, -1).Value =.Cells(Row,
2).Value
          .Rows(Row).EntireRow.Delete
        End With
      End If
    Row = Row + 1
  Next
rowscount = Worksheets("Raw Data").Cells(Rows.Count,
2).End(xlUp).Row
  For i = 2 To rowscount
    If Worksheets("Raw Data").Cells(i, 1).Value = "" Then
        With worksheets("Raw Data")
              .Cells(i, 1).Value =.Cells(i, 1).Offset(-1,
      0).Value
```

```
        End With
      End If
    Next
With Worksheets("Raw Data")
    .Columns("I:J").EntireColumn.Delete
    .Range(Cells(1, 1), Cells(rowscount, colcount)).AutoFilter
Field:=1, Criteria1:=Array("F-Assets", "LG Material", "T-F-
Assets", "T-Shoe Mat"), Operator:=xlFilterValues
    .Activate
    .Cells.Select
Selection.SpecialCells(xlCellTypeVisible).EntireRow.Delete
    .ShowAllData
    rowscount =.Cells(Rows.Count, 1).End(xlUp).Row
    .Cells(rowscount, 1).Value = ""
    Range("A1:H1048576").Sort Key1:=Range("H1"),
Order1:=xlDescending, Header:=xlYes
End With
Application.ScreenUpdating = True
    End Sub
```

Columns I:J are deleted and all those items are deleted which belong to the stores i.e. F-Assets, LG Material, T-F-Assets, T-Shoe Mat. In last, the values are set into descending order as per 8th column as can be seen in the fig.7.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | Warehouse | Row Labels | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 |
| 2 | Lthr Store | PolisherCow | 186754.25 | 306707 | 148547 | 25429751.59 | 43163756.58 | 21982345.8 |
| 3 | Lthr Store | London NbkCow | 92774.5 | 80160 | 96035 | 18044441.7 | 15610108.75 | 17447520.11 |
| 4 | Lthr Store | LCSSCow | | | 50056.6 | | | 12697266.7 |
| 5 | Lthr Store | Antique Wrap Shlmr PrntCow | 76789.75 | 106603 | 56802.75 | 10217067.8 | 14451183.48 | 7683954.74 |
| 6 | Shoe Mat | SOLARA Sole LT.TPR ImpSole | | | 15258 | | | 5158460.69 |
| 7 | Shoe Mat | TPR GrainTPR | 53030 | 81087 | 14313 | 11959926.5 | 21805055.1 | 4490373 |
| 8 | Lthr Store | PremiumBuff | | 10746.25 | 23252.5 | | 1807425.55 | 3665121.29 |
| 9 | Lthr Store | Lining SnuffedBuff | 130541.25 | 197101.25 | 64626.5 | 8828175.77 | 12522507.6 | 3642600.72 |
| 10 | Lthr Store | LRDCow | | 2291.25 | 23610 | | 469758.5 | 3613528.5 |
| 11 | Lthr Store | LCSJ EmbossCow | | | 9161.4 | | | 3506157.16 |
| 12 | Lthr Store | Nubuck SpecialCow | 3592.25 | 10984.5 | 21944.5 | 533923.72 | 1697976.42 | 3387594.63 |
| 13 | Shoe Mat | SocksPremouldedLatex LocSockPreLtx | 42480 | 46890 | 43322 | 3462840 | 5080812 | 3382848 |
| 14 | Lthr Store | Nubuck Milled PlatedCow | 9778 | 33677 | 23630.25 | 1941373 | 5386725.61 | 3273884.16 |
| 15 | Shoe Mat | Insole Shank BoardShtShnkBrd | 1080 | 2700 | 6021 | 359999.64 | 916665.76 | 2782110.87 |
| 16 | Shoe Mat | Kite PaperKitePaper | 3486 | 4200 | 4580 | 1436085.48 | 2487410.24 | 2726001.71 |
| 17 | Shoe Mat | Sole Seda Eva Rubber ImpSole | | | 4134 | | | 2695328.03 |
| 18 | Lthr Store | Rock Oily WaxyBuff | 32144.25 | 32478.5 | 26517.25 | 4527767.53 | 4925699.73 | 2692059.21 |
| 19 | Shoe Mat | Urban Sole SS18Shoe Box | | 112942 | 112000 | | 3353019.75 | 2638820 |
| 20 | Shoe Mat | Insole Wintex SheetShetWintex | 7725 | 7219.5 | 8398.5 | 1507498.95 | 1525531.43 | 2616495 |
| 21 | Shoe Mat | Pasting Solution LtrChemical | | 8800 | 8800 | | 2290000 | 2597313 |
| 22 | Shoe Mat | EyeletsEyeletRond | 1852000 | 1556300 | 1653500 | 1685065.95 | 1940557.71 | 2508594.93 |
| 23 | Shoe Mat | TPR EVA Capricon "TRAPPEUR" ImpSole | | | 5060 | | | 2479182.2 |
| 24 | Shoe Mat | Jana 100% ComfortShoe Box | | 8252 | 36821 | | 482742 | 2443568.4 |
| 25 | Shoe Mat | CartonsPackingCtn | 26094 | 24860 | 23158 | 2319657 | 2385677 | 2328793 |
| 26 | Lthr Store | London NbkBuff | 27606.5 | 79138 | 16120 | 3832218.66 | 11228265.57 | 2308776.63 |
| 27 | Lthr Store | Lining Snuffed vegBuff | 18782 | 16994 | 34066 | 1359909.55 | 1104186.98 | 2272091.03 |
| 28 | Lthr Store | Heel GripGoat | 32153 | 17710 | 21993 | 2715318.67 | 1540562.75 | 1979750.78 |
| 29 | Lthr Store | Split SuedCow | 13576.5 | 16914 | 22302.75 | 1031068 | 1423502.75 | 1684617.5 |
| 30 | Shoe Mat | Crimping Cloth LocalCloth | 14236.77 | 6578.4 | 14704 | 1288553.84 | 572872 | 1624070 |
| 31 | Shoe Mat | Socks Premoulded SolaraMid Socks | | | 15273 | | | 1617231.24 |
| 32 | Shoe Mat | Elastic ImportedElasticImp | 7400 | 10900 | 16215 | 1095758.34 | 1402497.19 | 1610630 |
| 33 | Shoe Mat | Fusing Clth Singl AdClothFusng | | 11092 | 6145.5 | | 2242000 | 1607684.75 |
| 34 | Shoe Mat | Rubber Foam SocksRbrFomSock | 10391.66 | 12152.31 | 8622.34 | 1409622.75 | 1733208.8 | 1568113.05 |
| 35 | Shoe Mat | LatexChemical | 6970 | 5125 | 6150 | 1613760 | 1121350 | 1517094 |
| 36 | Shoe Mat | Sheet ToePuf 25ShetToePuf | 12000 | 1624.5 | 3000 | 4563625.1 | 791398.14 | 1499999.9 |
| 37 | Shoe Mat | Syntc Socks LiningSyntSkLing | 4257.7 | 4030.75 | 7391 | 781450.7 | 890616.14 | 1458834.92 |
| 38 | Shoe Mat | Clifton Eva TPR Sole ImpSole | | | 2460 | | | 1425933 |
| 39 | T-G Store | GS-Eva Injection Mould Stud With ColingLast-PairMoulds | | | 4 | | | 1424773.19 |

Figure 7.   Result of above given code

*4)    Transfer Data*

Now the data read to be pasted into the 'Final Report' worksheet. By the help of macro given below, the data is transferred from 'Raw Data' worksheet to the 'Final Report' worksheet as given below in fig.8.

```
Sub transfer()
Application.ScreenUpdating = False
On Error Resume Next
rowscount = Worksheets("Raw Data").Cells(Rows.Count,
1).End(xlUp).Row
colcount = Worksheets("Raw Data").Cells(2,
Columns.Count).End(xlToLeft).Column
Worksheets("Final Report").Range("A4:H1048576").Value =
""

Row = 4
```

```
For i = 1 To rowscount
   For j = 1 To colcount
      With Worksheets("Final Report")
         .Cells(Row, j).Value = Worksheets("Raw
Data").Cells(Row - 2, j)
      End With
   Next j
   Row = Row + 1
Next
Application.ScreenUpdating = True
   End Sub
```

The average values of an each item for previous three years were calculated (I:K column); on the same time, quantity variance and average price of an item during pairs of years is also calculated (see fig.7 column L:O).

| | | Sum of Quantity | | | Sum of Financial cost amount | | | 3 year item average value | | | Quantity Variance | | 3 year item average | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Warehouse | Item | 2017 | 2018 | 2019 | 2017 | 2018 | 2019 | 2016 | 2017 | 2018 | 2016 and 2017 | 2017 and 2018 | 2016 and 2017 | 2017 and 2018 |
| Lthr Store | PolisherCow | 186754.3 | 306707 | 148547 | 25429752 | 43163757 | 21982346 | 136.1669 | 140.7329 | 147.9824 | 0.642303 | -0.51567 | 0.033532 | 0.051513 |
| Lthr Store | London NbkCow | 92774.5 | 80160 | 96035 | 18044442 | 15610109 | 17447520 | 194.4979 | 194.7369 | 181.6788 | -0.13597 | 0.198041 | 0.001229 | -0.06706 |
| Lthr Store | LCSSCow | | | 50056.6 | | | 12697267 | | | 253.6582 | | | | |
| Lthr Store | Antique Wrap Shlmr PrntCow | 76789.75 | 106603 | 56802.75 | 10217068 | 14451183 | 7683955 | 133.0525 | 135.5608 | 135.2743 | 0.388245 | -0.46716 | 0.018852 | -0.00211 |
| Shoe Mat | SOLARA Sole LT.TPR ImpSole | | | 15258 | | | 5158461 | | | 338.0824 | | | | |
| Shoe Mat | TPR GrainTPR | 53030 | 81087 | 14313 | 11959927 | 21805055 | 4490373 | 225.5313 | 268.9094 | 313.7269 | 0.529078 | -0.82349 | 0.192337 | 0.166564 |
| Lthr Store | PremiumBuff | | 10746.25 | 23252.5 | | 1807426 | 3665121 | | 168.1913 | 157.6227 | | 1.163778 | | -0.06284 |
| Lthr Store | Lining SnuffedBuff | 130541.3 | 197101.3 | 64626.5 | 8828176 | 12522508 | 3642601 | 67.62748 | 63.53337 | 56.36389 | 0.509877 | -0.67212 | -0.06054 | -0.11285 |
| Lthr Store | LRDCow | | 2291.25 | 23610 | | 469758.5 | 3613529 | | 205.0228 | 153.0508 | | 9.304419 | | -0.25349 |
| Lthr Store | LCSJ EmbossCow | | | 9161.4 | | | 3506157 | | | 382.7098 | | | | |
| Lthr Store | Nubuck SpecialCow | 3592.25 | 10984.5 | 21944.5 | 533923.7 | 1697976 | 3387595 | 148.6321 | 154.5793 | 154.371 | 2.057833 | 0.99777 | 0.040013 | -0.00135 |
| Shoe Mat | SocksPremouldedLatex LocSockPreLtx | 42480 | 46890 | 43322 | 3462840 | 5080812 | 3382848 | 81.51695 | 108.356 | 78.08615 | 0.103814 | -0.07609 | 0.329245 | -0.27936 |
| Lthr Store | Nubuck Milled PlatedCow | 9778 | 33677 | 23630.25 | 1941373 | 5386726 | 3273884 | 198.545 | 159.9527 | 138.5463 | 2.44416 | -0.29833 | -0.19438 | -0.13383 |
| Shoe Mat | Insole Shank BoardShtShnkBrd | 1080 | 2700 | 6021 | 359999.6 | 916665.8 | 2782111 | 333.333 | 339.5058 | 462.0679 | 1.5 | 1.23 | 0.018519 | 0.361001 |
| Shoe Mat | Kite PaperKitePaper | 3486 | 4200 | 4580 | 1436085 | 2487410 | 2726002 | 411.958 | 592.2405 | 595.1969 | 0.204819 | 0.090476 | 0.437624 | 0.004992 |
| Shoe Mat | Sole Seda Eva Rubber ImpSole | | | 4134 | | | 2695328 | | | 651.9903 | | | | |
| Lthr Store | Rock Oily WaxyBuff | 32144.25 | 32478.5 | 26517.25 | 4527768 | 4925700 | 2692059 | 140.8578 | 151.6603 | 101.5211 | 0.010398 | -0.18354 | 0.076691 | -0.3306 |
| Shoe Mat | Urban Sole SS18Shoe Box | | 112942 | 112000 | | 3353020 | 2638820 | | 29.58798 | 23.56089 | | -0.00834 | | -0.20638 |
| Shoe Mat | Insole Wintex SheetShetWintex | 7725 | 7219.5 | 8398.5 | 1507499 | 1525531 | 2616495 | 195.1455 | 211.3071 | 311.5431 | -0.06544 | 0.163308 | 0.082818 | 0.474362 |
| Shoe Mat | Pasting Solution LtrChemical | | 8800 | 8800 | | 2290000 | 2597313 | | 260.2273 | 295.1492 | | | 0 | 0.134198 |
| Shoe Mat | EyeletsEyeletRond | 1852000 | 1556300 | 1653500 | 1685066 | 1940558 | 2508595 | 0.909863 | 1.246905 | 1.517142 | -0.15967 | 0.062456 | 0.370431 | 0.216727 |
| Shoe Mat | TPR EVA Capricon "TRAPPEUR" ImpSole | | | 5060 | | | 2479192 | | | 489.957 | | | | |
| Shoe Mat | Jana 100% ComfortShoe Box | | 8252 | 36821 | | 482742 | 2443568 | | 58.5 | 66.36344 | | 3.46207 | | 0.134418 |
| Shoe Mat | CartonsPackingCtn | 26094 | 24860 | 23158 | 2319657 | 2385677 | 2328793 | 88.89618 | 95.96448 | 100.5611 | -0.04729 | -0.06846 | 0.079512 | 0.047899 |
| Lthr Store | London NbkBuff | 27606.5 | 79138 | 16120 | 3832219 | 11228266 | 2308777 | 138.8158 | 141.8821 | 143.2244 | 1.866544 | -0.79631 | 0.022089 | 0.00946 |
| Lthr Store | Lining Snuffed vegBuff | 18782 | 16994 | 34066 | 1359910 | 1104187 | 2272091 | 72.40494 | 64.97511 | 66.69674 | -0.0952 | 1.00459 | -0.10261 | 0.026497 |
| Lthr Store | Heel GripGoat | 32153 | 17710 | 21993 | 2715319 | 1540563 | 1979751 | 84.44993 | 86.9883 | 90.01731 | -0.4492 | 0.241841 | 0.030058 | 0.034821 |
| Lthr Store | Split SuedCow | 13576.5 | 16914 | 22302.75 | 1031068 | 1423503 | 1684618 | 75.94505 | 84.16121 | 75.53407 | 0.245829 | 0.318597 | 0.108186 | -0.10251 |
| Shoe Mat | Crimping Cloth LocalCloth | 14236.77 | 6578.4 | 14704 | 1288554 | 572872 | 1624070 | 90.50886 | 87.08379 | 110.4509 | -0.53793 | 1.235194 | -0.03784 | 0.268329 |
| Shoe Mat | Socks Premoulded SolaraMid Socks | | | 15273 | | | 1617231 | | | 105.8882 | | | | |
| Shoe Mat | Elastic ImportedElasticImp | 7400 | 10900 | 16215 | 1095758 | 1402497 | 1610630 | 148.0755 | 128.6695 | 99.32953 | 0.472973 | 0.487615 | -0.13105 | -0.22802 |
| Shoe Mat | Fusing Clth Singl AdClothFusng | | 11092 | 6145.5 | | 2242000 | 1607685 | | 202.1277 | 261.6036 | | -0.44595 | | 0.294249 |
| Shoe Mat | Rubber Foam SocksRbrFomSock | 10391.66 | 12152.31 | 8622.34 | 1409623 | 1733209 | 1568113 | 135.6494 | 142.6238 | 181.8663 | 0.169429 | -0.29048 | 0.051415 | 0.275147 |
| Shoe Mat | LatexChemical | 6970 | 5125 | 6150 | 1613760 | 1121350 | 1517094 | 231.5294 | 218.8 | 246.682 | -0.26471 | 0.2 | -0.05498 | 0.127431 |

Figure 8.    Result of above given code

## 5) Time Consumed by New Method

After the automation of vendor rate analysis report, the time study of the report was conducted by using stop watch and processing time of each of the command button was recorded.
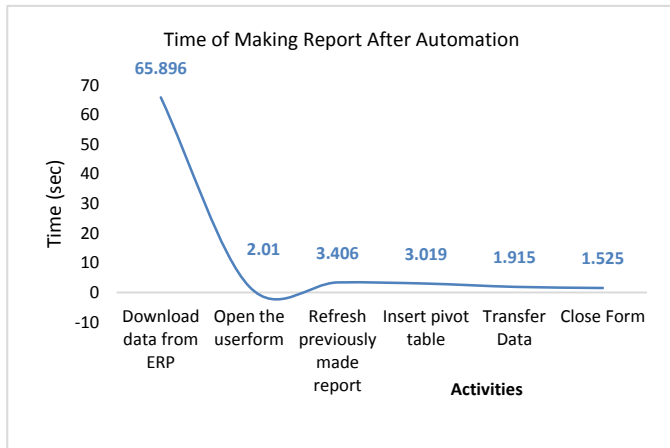


Figure 9. Time taken by the various activities of the report`s preparation after its automation

After totaling up the time of all activities (as presented in the fig. 9), it was revealed that the overall report took time of 77.771 sec (1.296 min).

## IX. COMPARISON OF BOTH METHODS

When the report was used to be made manually, it used to take 11.33 minutes as discussed in 8.1 and it takes 1.296 minutes after automation. Authors succeeded in minimizing the overall report predation time and they reduced 88.56% of the time. At the same time, the automated version of the report was error free, after its testing and result verification.

## X. DISCUSSION

Workers are employed for every single small and also moderate enterprise (SME) for making reports on daily regular monthly and also annual basis. Nearly all of the report in pointed out market is executed in MS excel. Often in MS excel there are more opportunities of error and it takes enormous quantity of time normally in case of complicated reporting. Therefore MS has actually provided mouldability of personalized automation in its applications like Excel Word Power factor and VBA. The deal with VBA is performed in aesthetic standard editor (VBE). For that reason, Various other technologies are created by Microsoft that are VBA, VSTO, ActiveX and also etc. [11][33]. VBA systems is given on the system of numerous softwares of Microsoft window [34][10][24]. Nowadays firms, industries, workers are implementing to obtain the details and expertise of using VBA [35]. When it has to do with VBA, after that it is about the modification and also growth in incorporated development

setting (IDE) in the applications of MS office for the automation and also simplification of manual, complicated and also duplicated work [11][20][36][24][34]. Just, it is recognized for automating the regular work in existing workplace performance applications [11][35]. Goal of the present research was to automate the product distribution time report evaluation. However when staff members often used to fail to remember the actions of making the report and due to this possibility of error was greater, this report was used to be prepared at that situation company as soon as in a month. Variety of macros were programed to carry out those commands which were as soon as done manually in excel. All the macros got on the hand of userforms to provide command as they could be start by clicking when. Userforms are used when the input from user is to be taken [20]. A code is required to make sure that operations can be run by itself. [20][24][26]. If literature is traced back as well as the prevalence of exact same research is found. Like VBA was utilized by Bartoszewicz and Wdowicz (2019) in comparison to remake and perform the process for migration of data and its evaluation, it was much faster, adaptable as well as the means to speed the complicated logical report development, contrast of old and also brand-new method exposed that by the assistance of VBA, and also as usual time of report was decreased type 2 hrs to 5 mins [23]. Furthermore VBA was likewise made use of by Cirujano as well as Zhu (2013 ), they executed a work with the manpower resource planning report, a skilled employee needed to benefit 30 functioning hours to make the report but after the automation by VBA, it takes 10 mins [14]. Kalwar M.A et al. 2020 made use of VBA for the automation of regularly made report in MS excel and also saved 88.56% of the total time[37]; just like that, by using VBA. Kalwar and Khan (2020) automated the acquisition report at the making as well as costing department of the company by which 75% of the employee's time was conserved [26]. Rather than using old method which took 5.324 minutes for preparing the product distribution analysis however by using brand-new technique it takes 1.55 minutes. Contrast of the moment research study of both techniques shows that the new approach takes 70.86% less time as contrasted to the old approach. It is noticeable that new method is more beneficial and there is no any kind of possibility of mistake in the report as if fundamental data is 100% accurate because of automated procedure. In Addition, Kalwar M.A, Marri H.B and also Khan M.A, 2020 additionally automated among report at planning department at the shoes manufacturing and also they reduced the 84.42% of the complete time [38]. By using VBA Yan and Wan (2017) created a device of generating expense of material of transmission line; effectiveness as well as accuracy of calculation are tremendously boosted, at the same time, mistakes in the computation process of steel BOMs were decreased [25]. VBA was additionally used by Abidin et al., (2013) and figured API and also WQI in the automated method. By doing this the errors turnaround time were reduced.

## XI. CONCLUSION

Automated systems have actually constantly been time conserving and also efficient especially in the computerized work. Similarly, vendor price analysis report automated by the

help of visual basic for applications (VBA). Time study of old as well as mechanized technique for making the supplier price analysis report was conducted. In old technique, customer utilized to take 680.326 sec (11.33 min) to prepare the vendor rate analysis report; whereas, by new technique he/she require 77.771 (1.29 min) to make the vendor price evaluation report. The contrast of both approaches showed that the new technique takes 88.56% less time as compared to old technique (manual method).

## XII.   FUTURE IMPLICATIONS

The mechanism of automated report formation can be incorporated in Microsoft Dynamics AX 2012 which is already implemented there; thus authors of this paper suggest that it should be implemented in AX ERP because excel automation is not the permanent solution.

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## CONFLICT OF INTERESTS

There was no conflict of interest among the authors of present research paper.

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