WPOM

Working Papers on Operations Management.
Vol. 14, Nº2 (101-137)
ISSN: 1989-9068

https://doi.org/10.4995/wpom.18697

Automation of Post-Order Costing Analysis ByUsing Visual Basic For Applications In Microsoft Excel: A Case Study

Muhammad Ahmed Kalwar[a], Muhammad Ali Khan[b], Asif Nawaz Wassan[c], Zuhaib Phul[d], Shakeel Ahmed Shaikh[e], Hussain Bux Marri[f]

[a]Assistant Manager, Production Department, Shafi Private Limited, Lahore, Punjab, Pakistan. kalwar.muhammad.ahmed@gmail.com. [b]Professor (Assistant), Industrial Engineering & Management, Faculty of Mechanical Process & Earth Engineering, Mehran University of Engineering & Technology, Jamshoro, 76062, Sindh, Pakistan. muhammad.nagar@faculty.muet.edu.pk. [c]Post Graduate Student, Department of Industrial Engineering & Management, Faculty Faculty of Mechanical Process & Earth Engineering, Mehran University of Engineering & Technology, Jamshoro, 76062, Sindh, Pakistan.asif.wassan123@gmail.com. [d]Post Graduate Student, Department of Computer Science, Sindh Madressatul-Islam University, Karachi, 74000, Sindh, Pakistan. zuhaibphul53@gmail.com. [e]Professor (Associate) &Co-Director (Post Graduate Studies), Faculty ofMechanical Process & Earth Engineering, Mehran University of Engineering & Technology, Jamshoro, 76062, Sindh, Pakistan. shakeel.shaikh@faculty.muet.edu.pk. [f]Professor (Meritorious) & Dean of Faculty, Faculty of Engineering Technology, Benazir Bhutto Shaheed University of Technology and Skill Development (BBSUTSD), Khairpur Mirs, 66020, Sindh, Pakistan.hussainbux@bbsutsd.edu.pk

Recibido: 2022-11-03 Aceptado: 2023-06-24

To cite this article: Kalwar, Muhammad Ahmed; Khan, Muhammad Ali; Wassan, Asif Nawaz; Phul, Zuhaib; Shaikh, Shakeel Ahmed; Marri, Hussain Bux (2023). *Automation of Post-Order Costing Analysis ByUsing Visual Basic For Applications In Microsoft Excel: A Case Study. WPOM-Working Papers on Operations Management,* 14 (2), 101-136. doi: https://doi.org/10.4995/wpom.18697

Abstract

Microsoft Excel is used to carry out reporting tasks in small and medium companies across the globe. Most people make reports manually in Microsoft Excel and the manual work takes a tremendous amount of time. The manual work can be easily automated with some effort in Microsoft Excel. This research is about the automation of report that was used to be made manually in Microsoft Excel.The present research is an extension of the previously conducted research (Kalwar, Shahzad, et al., 2022)*. The manual process to make the post-order costing analysis report in MS excel requires a lot of user time (22.80 minutes, just if there is a single order of only one article with one color), with the greater possibility of human error. Employees in ananonymous footwear company in Lahore used to generate the post-order costing report manually in Excel.Due to the above-mentioned reasons, it was proposedto automate the report using visual basic for applications (VBA) in Microsoft Excel.The planning and costing departmentof the company provided every single step required to make the report manually. A time study was conducted for each stepof report preparation using the stopwatch.VBA macros were programmed for automating all manual report-related processes in excel andthe accuracy of the report was also verified. After the report was automated, the time study was again conducted to measure the execution time after each click. A comparison of both methods indicated that the report automation saved 83.18% of*

employees' time Additionally, the automatedmethod resulted in an error-free report, and the employee`sworkload was reducedas well.

Keywords:*macros; VBA programming; report automation; reporting efficiency.*

Authors Contribution

The first and second authors contributed to the study conception and design, search protocol, selection & analysis of the records, interpretation of the data. The first and second authors had has completed the methodology and data analysis section also. The first author had the main responsibility of drafting the manuscript, while the main responsibility of the second, fifth & sixth authors was to critically review the manuscript and refine it, as well as, serving as a scientific advisor for the intellectual content of the study. The third and fourth authors contributed in the presentation of data, tables and figures and general proofreading and formatting of the manuscript. The first and second authors carried out the final revision, approved the final version and contributed to its final editing. The discussion and conclusion section is done by all authors.

Introduction

Information technology plays an incredible role in the calculation, processing, and retrieval of data. The extraction of useful information from organized sets of data is the basic task of data analysts at any organization. The primary tool that helps organizationsto process data and make decisions is a management information system (Karim, 2011). Productivity Improvement is the concern for the manufacturing sector (Bukhsh et al., 2021; Iftikhar et al., 2021; Iftikhar, Khan, et al., 2022; Iftikhar, Kumar, et al., 2022; Jaleel et al., 2021; K. Khan et al., 2021; Rajput et al., 2020) and footwear industry should continuously explore the use of IT to improve the overall productivity. Performance evaluation is necessary for the competitive organizations (Kalwar, Khan, et al., 2022; Kumar et al., 2020) and the footwear industry should continuously update the performance evaluation criteria also with the changing business environment. Management information systems are used to store and process the large amounts of data in the central database; at the same time, spreadsheets are commonly used in small and medium-sized businesses for interdepartmental reporting, including costing, planning, etc. spreadsheets are commonly used for multiple purposes such as data entry, analysis, visualization, and storage. Many spreadsheet programs are used for the above-mentioned tasks (Broman et al., 2017). It is challenging to create a trustworthy spreadsheet, as reported from the experiences of practitioners(Dunn, 2009). The most popular programming language in use today is a spreadsheet (Fisher et al., 2002). Spreadsheets are used by both businesses and people for many purposes such as completing quick computations (Abraham et al., 2008). A large amount of information system is needed by large firms to carry out their routinetasks, but if the data is small, the system can be developed using VBA in the applications of Microsoft Office (Microsoft Excel, Word, Access). The programming known as visual basic for applications (VBA) enables users to save formulas and procedures as lines of computer code known as “macros” (Perry, 2012). The systems created by using VBA in excel are free or inexpensive, and they allow for the execution of sophisticated analyses with excellent performance. Additionally, analysts with less experience can deliver correct results more quickly (Blayney & Sun, 2019)using VBA in Microsoft Excel. Excel macros can be executed by simply clicking the button once the programming part is done. Users can create user-defined functions and automate all

spreadsheet tasks by using VBA (Abraham et al., 2008). When compared to excel formulas, VBA is very different and the given programming environment (visual basic editor) is also different (Abraham et al., 2008).Balson(2012) described a technique for creating a constrained version of user-defined spreadsheet functions (USDFs) in Microsoft excel. However, it was preferable to program all necessary USDFs in a module with a dynamic input range so that a regular user might afterward use the functions in the spreadsheet(Balson, 2012).

There is the great potential for the implementation of Advance Manufacturing Technologies (AMTs) for the productivity improvement in the assembly & production lines of Pakistani Industry. It is observed that unlike the other developed countries, very few case studies are conducted to explore the potential of Advance Manufacturing Technologies (AMTs) in the Pakistani Industry. The awareness of the applications of Advance Manufacturing Technologies (AMTs) in stitching, pharmaceutical, automobile, textile and footwear industries of Pakistan for the productivity improvement and optimization of the processes is now increasing rapidly (M. A. Khan, Soomro, et al., 2020), (M. A. Khan, Memon, et al., 2020), (M. A. Khan, 2018), (M. A. Khan, Marri, et al., 2020), (M. A. Khan, Khatri, et al., 2020). Excel was identified as a potent tool for MC simulation by Alexei Botchkarev after he evaluated the applicability of Monte Carlo (MC) Simulation in VBA using Microsoft Excel (Botchkarev, 2015). According to Ajinkya et al. (2017), Microsoft Excel can be usedfor the estimation of the quantity and cost of construction work, including excavation, brickwork,PCC, plastering, and RCC (S. Ajinkya et al., 2017). For identifying suspicious measuring points and inserting information for missing values, Raza and Gulwaniemployed VBA in excel (Raza & Gulwani, 2017). Very few research articles found on spreadsheet automation in the context of industrial reporting, such as budgeting, costing, scheduling, etc. have been published exceptfor basic materials. By using VBA to execute conditional decision-making automatically, this study helps enterprises find a solution. Industries require visual basics for applications particularly when reporting efficiency and accuracy are to be increased. In the gravity of the usefulness of VBA in Microsoft Excel, the post-order costing report at the planning and costing department of the anonymous footwear company was automated. The automation of the post-order costing report is comprehended in this research paper.

Literature Review

The costing calculations were maintained in line with the anonymous company's costing department's specifications and the mutual operation in the report was eliminated by the use of visual basics for applications. The study is about report automation using VBA. In 2015, Zainal Abidin et al., conducted research to create an application that uses VBA in Microsoft to calculate the water quality index (WQI) and air pollution index (API). The application was configured to calculate the indices directly. the necessary formulas were converted into code. additionally, each index's description was designed so that the measured index values specified could be shown automatically (Abidin et al., 2015). Ahmadi et al., (2018) used VBA in Microsoft Excelto developthe CTR dairy model. The dynamic simulation model for grazing lactating dairy cows and CTR dairy is used to estimate milk output and profits based on several characteristics such as ruminal digestion and nutrient absorption under intermittent feeding schedules. The CTR dairy model was used as a basic input to develop a VBA program in Microsoft Excelthat turned the input into output. It was made available to a wide range of dairy farmers, dairy nutrition consultants, extension advisors, and academics (Ahmadi et al., 2018).To post-process the data from the reactor excursion and leak analysis program 5 (RELAP5), Junior et al., (2011) created a new application based on VBA in Mi-

crosoft Excel. It increased the efficiency of output generation and it proved to be very helpful(Belchior Junior et al., 2011). The application for the automated organization of data and the identification of outliners in the data was programmed by Rushit Hila (2009) using VBA in Microsoft Excel. Before importing data into MS access (which served as the database), several tasks were automated in the program; the application saved a tremendous amount of user time (Hila, 2009). Cirujano and Zhu (2013) worked on the automation of the manpower planning reports in Microsoft Excel using VBA.Roles and schedules of engineers working on various projects were compiled using the developed template. In this way, plans for the engineers could be created and information on the engineers' involvement in various projects could be acquired. The technique was tested at a consulting firm with over 100 employees. It was mentioned that the reports of manpower planning can be produced via the automated template, which saved a significant amount of time and money (Cirujano & Zhu, 2013).Through the use of VBA in excel, Sato and Yokoyama (2001) created an application that allows users to click a webicon to transfer image data from a dataset to a worksheet (Sato & Yokoyama, 2001). Using visual basic for application (VBA) in excel, Lessa, et al., (2016) automated a useful mathematical model for the computation of packing and the logic program.The graphic designs were generated in the application for how the packages are being filled. Most importantly, the application was useful in logistics planning(Lessa et al., 2016).

Instruments communication was initially developed in Microsoft Excel (Evensen, 2014). An automatic report generation system was created by Donald E. Blattner and Valrico, Florida (2007) utilizing VBA in Microsoft Project.By using the help dialogue box that appeared on the screen, the user could choose, filter, format, and sort the report using the developed system (Blattner & Valrico, 2007). To construct mapping rules, Wettlaufer (2010) used VBA macros in excel. A single macro was created for every report. The second spreadsheet known as the expected values spreadsheet is where the expected values were written by the macros. The patient follow-up is then sent to the merline.net server to be processed, and the results used to be generated in a Winrarfile (Wettlaufer, 2010). To help engineering students grasp the study of innovative freezing technology, Norton and Tiwari (2013) developed code using VBA in Microsoft Excel (Norton & Tiwari, 2013). Bartoszewicz and Wdowicz (2019) combined the production planning module of SAP enterprise resource planning (ERP) with an excel spreadsheet and VBA for visualization and automation.The entire process of creating a difficult analytical report was made quicker (operation time was lowered from 2 hours to 5 minutes) by redesigning and implementing a new procedure for data movement and analysis that was more flexible and quick (Bartoszewicz & Wdowicz, 2019). Harahap and Azmi (2017) researchedto create an application utilizing VBA in Microsoft Excel that could create a small-scale conveyance system for rainwater using a rational manner described in MSMA2 (Harahap & Azmi, 2017). Yan and Wan (2017) created an application using excel VBA for the automatic computation and development of a transmission line's bill of materials (BOM). The design and use of the template considerably increase efficiency and accuracy while lowering errors during the production of the whole steel BOM (Yan & Wan, 2017). In the footwear business, Kalwar and Khan (2020) automated the procurement and purchase order report; before automation, the procurement report took 2076.751 seconds to complete instead of 516.578 seconds. Additionally, after automation, a purchase order takes 2-3 seconds instead of 15-20 minutes (Kalwar & Khan, 2020b).

Table 1. Findings from the literature review

Author	Method	Findings
(Chaudhry et al., 2021)	VBA in Microsoft Excel	They initiated a spreadsheet at the Pakistan Civil aviation authority and name it a small management information system because the spreadsheet contained all the data regarding the purchase orders and complaints from various locations across Pakistan. They automated the spreadsheet using VBA to save the employee time that used to be incurred on searching and tracking the complaints. The system saved a tremendous amount of time of an employee.
(Bartoszewicz & Wdowicz, 2019)	VBA in Microsoft Excel	They combined the production planning module of SAP enterprise resource planning (ERP) with an excel spreadsheet and VBA for visualization and automation. The entire process of creating an analytical report was made quicker (operation time was lowered from 2 hours to 5 minutes) by redesigning and implementing a new procedure for the migration of data and its analysis more flexibly and quickly.
(M. A. Khan, Kalwar, & Chaudhry, 2021)	VBA in Microsoft Excel	The authors automated the material delivery time analysis report using VBA in Microsoft Excel. The report was programmed using macros and an automated template reducingthe time of report generation by 70.86%.
(Ahmadi et al., 2018)	VBA in Microsoft Excel	They used VBA in Microsoft Excel to develop the CTR dairy model. The dynamic simulation model for grazing lactating dairy cows and CTR dairy is used to estimate milk output and profits based on several characteristics such as ruminal digestion and nutrient absorption under intermittent feeding schedules.
(M. A. Khan, Kalwar, Malik, et al., 2021)	VBA in Microsoft Excel	The authors automated the suppliers` price evaluation report using VBA in Microsoft Excel. The report was programmed using macros and the programmed report reduced the time of report preparation by 88.56%.
(Abidin et al., 2015)	VBA in Microsoft Excel	They used VBA in Microsoft to calculate the WQI and API. The application was configured to calculate the indices directly. the necessary formulas were converted into the VBA program. Moreover, the description of each description of the index was designed so that the specific index values could be shown automatically.
(Kalwar, Shahzad, et al., 2022)	VBA in Microsoft Excel	They automated the order costing report in Microsoft Excel using VBA. The report minimized the employee`s time by 85.92%.
(Lessa et al., 2016)	VBA in Microsoft Excel	They automated a useful mathematical model for the computation of packing and the logic program. The graphic designs were generated in the application for how the packages are being filled. Most importantly, the application was useful in the logistics planning

Table 1 indicates that the various researchers have made use of VBA in Microsoft Excel to automate several tasks for the convenience of the employees. Moreover, a significant increase in task completion

time was also noticed. The VBA in Microsoft Excel worksheet is being used effectively for optimization of operations in many recent studies. The more recent related studies include the development of small management information system to store & retrieve data with ease & speed (Chaudhry et al., 2021) ; to integrate ERP module (Bartoszewicz & Wdowicz, 2019); to conduct material cost comparative analysis (M. A. Khan, Kalwar, & Chaudhry, 2021); to estimate dairy milk production (Ahmadi et al., 2018); to calculate WQI and API (Abidin et al., 2015); to conduct order costing analysis (Kalwar, Shahzad, et al., 2022); to generate the output of mathematical model (Lessa et al., 2016); to optimize procurement order process (Kalwar & Khan, 2020a); to automate plan paper generating workbook (Kalwar, Muhammad Ahmed; Wassan et al., 2023); to optimize purchase order process (Kalwar & Khan, 2020b); to automate the manpower planning reports (Cirujano & Zhu, 2013). All the discussed authors have contributed in using VBA for the generation of mathematical model output, the analysis of data, and estimation of variables. Whereas, in the present research, the post-order costing report was automated using VBA in Microsoft Excel, the authors have used the userforms and inserted buttons on them for the execution of macros, Furthermore, the output of the automated template was generated in a fashion same as the output of the report was used to be generated manually. This contribution of the present research cannot be ignored because it is about a report that was automated completely; it did not require even a single operation (even of a few seconds) to be done by the employee during the report generation process.

Research Methodology

Reporting Process of Company and Description of Problem

In the case company, the invoice is received (see Figure 1) by the marketing department and it is supposed to communicate it with the planning and costing department for the preparation of the initial costing report; at the same time, the research and development department is instructed to get the sample ready.

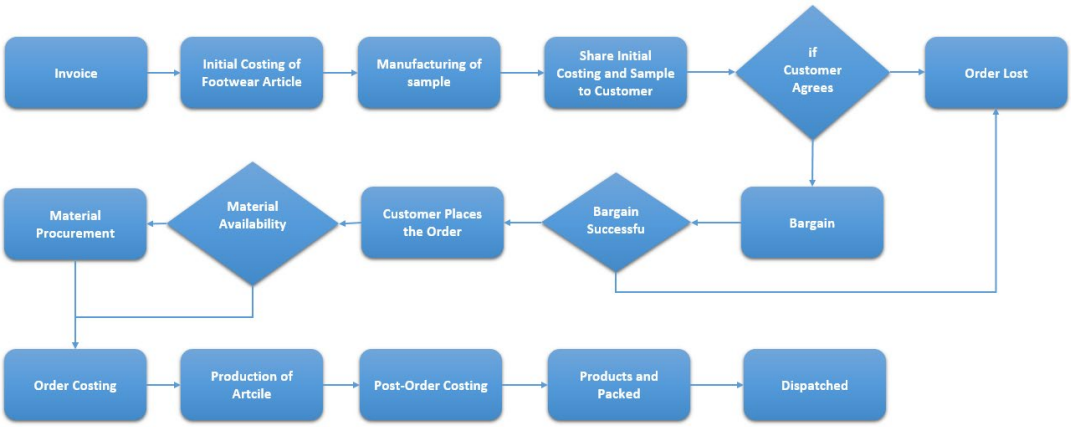


Figure 1. The process flow chart of the case company

The initial costing report covers the material to be used in the footwear article and the material cost is supposed to be estimated; the labor cost (labor from cutting, sewing, and lasting) to be incurred on the article and the overheads are estimated as well. After all the estimations, the prices of the specific articles are quoted to the customer along with the footwear article samples; if he/she agrees to the prices then he

places the order; it is also the possibility that the customer gets the materials changed to be used in the article in the caseif they are costly and increasing the price of the article. After the order is placed, the planning and costing department is informed about it and it prepares the procurement report and processes it to the procurement department at the same time, it prepares the order-costing report. The order costing report contains the estimated cost of the whole order from one customer. After the material is procured, the production of the footwear article starts,and after the production is finished the planning and costing department is supposed to prepare the post-order costing report so that actual costs incurred on the particular order can be highlighted. The produced articles are then dispatched to the customer at the given destination.

In this research, the post-order costing report was selected because of its time-consuming nature. Since the volume of the orders at the company is quite large, this is because the employee was not able to match the pace orders, therefore, it is extremely needed to reduce the workload of the employee and increase the reporting efficiency of ht planning and costing department at the same time. Therefore, in the present research, the post-order costing report was automated using VBA in Microsoft Excel, the authors have used the userforms and inserted buttons on them for the execution of macros, Furthermore, the report was automated in s fashion as the employee used to work on the report manually. This contribution of the present research cannot be ignored because it is about a report that was automated completely; it did not require even a single operation (even fo ra few seconds) to be done by the employee during the report generation process.

Research Method/Approach

A case report paper presents a story in narrative form and includes current individual or organizational concerns, situational diagnoses, interventions, outcomes including adverse events, and follow-up (Marin-Garcia et al., 2022). Garcia et al. (2022) provided the detailed guidelines of preparing case study articles to facilitate its accuracy, transparency, and usefulness for the scientific field of Operations Management (Marin-Garcia et al., 2022). Several research methods are adopted and used in the conduct of the research activity. The research methods include experimental research, qualitative/quantitative research, ground theory, Quasi-experiment, survey, cross-sectional research, cohort research, action research, etc. and this research was conducted in light of action research. Kurt Lewin, an MIT professor first coined action research in the year 1944 (George, 2023). This research method is used in several fields, particularly in social sciences and educational sciences. This research is used to bring about improvement in professional practice and outcomes; the gaps are identified with the help of this method to genuinely improve that work in practice (George, 2023). Since this research is also about the improving the method of conducting post-order costing analysis from manual making to automated analysis. The authors firstly highlighted the gap and then found the method to improve the reporting process and then the solution of using VBA was decided to automate the analysis and this whole scenario comes under the domain of action research.

Data Collection

Initially, the report was selected for the automation and then the steps and procedure to prepare the reports were gathered from the concerned person in the costing and planning division of the company in Lahore, Pakistan. The data collection indicated that 45 activities were required to prepare the post-order costing report and the sequence of each activity was set to automate the report accurately and systematically. The time required to complete each of the activities was recorded by using a stopwatch. Ten obser-

vations (the time to perform the manual task in Microsoft Excel) for each of the activities were collected. The listed activities were entered into Microsoft Excel along with their recorded observation and then the average time to complete each of the activities was calculated. After the collection of activities to make the report was complete then the data regarding an obsolete order was collected before the automation. Since a programmer writes a VBA code to automate a manual task, it requires data to verify the accurate working of code; in this regard, the data of an obsolete order was collected from the costing department of the company. There was no consent required from the company because the collected data was obsolete and the company bears no loss if it is disclosed.

Automation Using VBA

Manual tasks were automated using the programming language called visual basic for applications (VBA) in Microsoft excel. Every single task including adding and deleting rows and columns, combining values from two or more columns, transferring data between sheets, counting the number of rows in the work-sheet that isn't empty, using vlookup formulas, adding pivot tables, copying and pasting data, etc., were programmed using VBA in terms of macros. All of the coded macros could be run by clicking command buttons that were inserted on an attractive user interface i.e. userfrom. When a user presses"Ctrl+q" the userformappearss on the screen. Furthermore, after the automation of the report, the time study was conducted again on every single execution step of the automated template so that the report generation time before and after the automation could be compared to reflect the increased efficiency.

Timeline

The automation process of the post-order costing report included the five steps as given in Figure 2. The post-order costing report was understood by the authors at the very first from the employee who was supposed to make the report; secondly, the time study of each step was conducted so that the time to complete the report could be documented. The data collection and time study of the manual process of report generation took one working day. The macros were then programmed to automate the report as per the way it was used to be generated manually and this step took two weeks. The fourth step was the verification of output and the implementation of the report; this step also took two weeks because the report was not a regular one. The implementation process was challenging because the employee had no idea about VBA and automated reporting; he was made to understand of whole process of the automated post-order cosingreport template (data fetching, the report generation process, and error correction). The final step was to conduct a time study of the automated template so that both methods could be compared to reflect the employee`s increased reporting efficiency. The last step of the report automation process took half an hour to be completed.

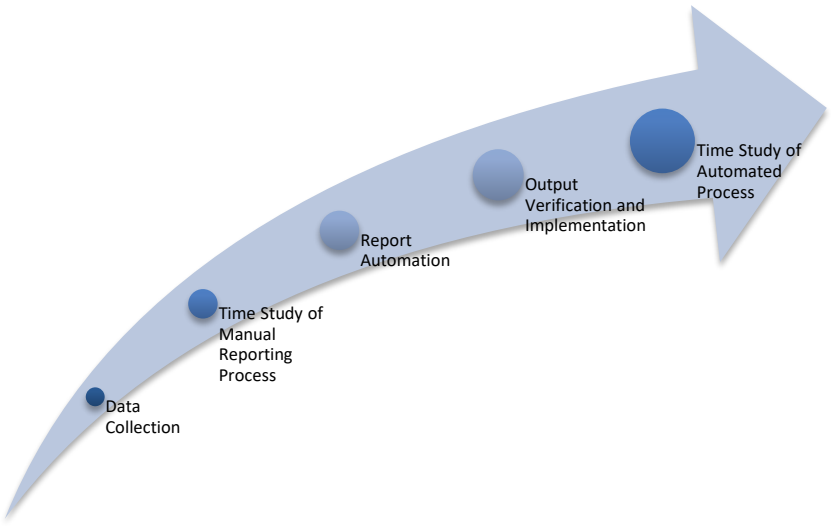


Figure 2. The timeline of this report automation

Post Order Costing

The planning and costing department was tasked with the generation ofpost-order costing reports for each order on its completion. The discrepancy between the estimated and actual costs for the orders can be the used material cost (leather and other material costs if they are incurred more/less than estimation), tooling, labor, overhead, and B-pair wassupposed to be shown in the post-order costing report. The exact cost of the specific order which includes several items (shoes) in various sizes and colors is calculated. Regardless of the type of production, the ultimate goal of any firm is to multiply the money in the form of profit. Therefore, the company must understand the tooland the way it is supposed to be utilized, which is known as "cost" (Şuteu et al., 2016). The cost management system is the collection of many defined techniques for budgeting and expense management so that the organizational goal can be accomplished(Keramatpanah et al., 2016). Order costing is one of the primary methods for estimating the cost to be incurred on the production order.

Since the post-order costing includes the calculation of material incurred in the production order in real-time, the actual time of labor, and actual overheads. The data required for the analysis requires time to collect and analyzed; the employee used his/her tremendous amount of time to make this report. A set of 45 activities were supposed to be performed to make the post-order costing report. Since a long sequence of activities are required in the manual formation of the report and if the employee misses one activity, the whole report goes wrong and it wasa very difficult and time-consuming job to locate that error in the spreadsheet. Moreover, there was no justified framework available at the company to audit the report; when it is submitted, manager used to take a glance and somehow verifies the values of prices and labor costs. The employee and the manager have no idea to accurately audit the report. Therefore, the template was required to be initiated that could provide 100% accuracy and save the time spent on manual work. This is because the report was targeted for automation so that the employee`s time could be saved and his workload could be reduced. Most importantly, the reporting efficiency of the department wasintended to be increased. In this regard, the report automation through VBA in Microsoft Excel was conducted. All

the related notations, indices and parameters are mentioned in annexure 1, annexure 1 and annexure 3 respectively. The automation process started with data collection and the time study of every single activity performed in the manual making of the report as given in Table 2.

Existing Method for the Preparation of Post-Order Costing Report

The employee who was responsible for making the post-order costing report was contacted so the data/information regarding the report could be collected. Every single activity required to make the report was listed at the very first as given in Table 2. It indicates that 45 unique activities were used to be performed to make the complete report. It can be seen that the manual report-making takes a tremendous amount of employee time and it consists of a large set of tasks to be performed in Microsoft Excel. The first activity (*a1*) used to take the maximum of the employee`s time because in activity *a1*(see Table 2 and Figure 3), the employee was supposed to download the required data from ERP and it needed time to fetch and download the data. The time for the to perform activities i.e. *a8*, *a23*, and a35 is around 1 minute and this takes a long because according to these activities, an employee has to fetch the data from two different workbooks i.e. sale order detail (for *a8*) and order costing workbooks (for *a23* and *a35*)(see Table 2 and Figure 3).Since the data from which the post-order costing report is supposed to be made is huge in volume and pivot tables are required to summarize it and due to the larger volume, pivot tables take time to summarize it; this is the reason that activities i.e. a8 and a25 requires more time to be performed. When it is about the cost calculations and the data is available in different worksheets and workbooks, it becomes time-consuming for an employee to calculate the costs. Similarly, the time required for the activities from *a39* to *a41* is greater than 2 minutes because these activities require manual calculations of labor cost, tooling cost, and overheads respectively(see Table 2 and Figure 3). The time required to complete the last activity i.e. *a45* is also around 2 minutes because, in that activity, an employee is supposed to put the pictures (they are fetched from the different folders of the computer) of the footwear articles present in the report. Ten observations of time study for each activity were collected through a stopwatch and the average time to complete each activity was calculated in Microsoft Excel which is mentioned in Table 2.

Table 2. time study of the various tasks which are performed to make the post-order costing report

Notation	Obs.1 (Sec)	Obs.2 (Sec)	Obs.3 (Sec)	Obs.4 (Sec)	Obs.5 (Sec)	Obs.6 (Sec)	Obs.7 (Sec)	Obs.8 (Sec)	Obs.9 (Sec)	Obs.10 (Sec)	Mean Time (Sec)
a1	162.4	260.6	283.7	218.1	177.4	173.74	295.2	221.5	197.01	240.15	223.014
a2	12.92	12.81	6.89	7.84	8.86	15.83	11.94	13.7	13.91	15.29	11.999
a3	8.25	10.41	8.13	9.34	10.2	8.27	12.91	10.52	10.46	7.8	9.629
a4	2.6	2.57	2.88	3.81	2.45	4.91	3.68	2.7	3.8	3.08	3.248
a5	6.4	5.94	6.07	6.99	8.58	5.6	4.89	6.96	5.41	6.38	6.322
a6	5.02	5.07	3.05	5.03	5.38	4.76	4.4	5.99	4.65	4.89	4.824
a7	12.46	10.2	11.88	10.84	9.37	8.05	11.17	10.93	8.59	11.5	10.499
a8	76.19	45.65	62.49	68.12	78.66	60.97	73.25	74.03	78.86	66.21	68.443
a9	14.74	18.09	18.47	11.15	17.99	14.27	13.46	11.41	18.46	13.07	15.112
a10	21.39	21.58	20.88	20.4	18.68	18.72	22.44	19.07	22	16.39	20.155
a11	4.66	3.92	7.26	5.16	4.14	5.24	6.23	6.18	5.47	4.5	5.276
a12	4.66	3.92	7.26	5.16	4.14	5.24	6.23	6.18	5.47	4.5	5.276
a13	4.66	3.92	7.26	5.16	4.14	5.24	6.23	6.18	5.47	4.5	5.276
a14	24.44	17.99	17.65	21.65	20.58	20.14	19.76	21.99	18.22	17.94	20.036
a15	39.95	41.67	34.51	39.67	40.62	42.9	38.14	41.3	34.72	41.31	39.479
a16	13.74	13.68	18.15	13.64	16.08	13.58	14.07	14.29	17.39	14.28	14.89
a17	4.66	3.92	7.26	5.16	4.14	5.24	6.23	6.18	5.47	4.5	5.276
a18	6.17	7.74	7.08	5.99	6.09	5.35	6.22	5.58	7.93	7.97	6.612
a19	2.6	2.57	2.88	3.81	2.45	4.91	3.68	2.7	3.8	3.08	3.248
a20	12.46	10.2	11.88	10.84	9.37	8.05	11.17	10.93	8.59	11.5	10.499
a21	12.05	5.53	7.45	12.71	10.27	17.63	11.25	15.21	6.34	3.57	10.201
a22	12.05	5.53	7.45	12.71	10.27	17.63	11.25	15.21	6.34	3.57	10.201
a23	65.46	72.27	49.01	58.26	65.66	44.69	68.64	61.28	71.17	55.74	61.218
a24	6.17	7.74	7.08	5.99	6.09	5.35	6.22	5.58	7.93	7.97	6.612
a25	39.95	41.67	34.51	39.67	40.62	42.9	38.14	41.3	34.72	41.31	39.479
a26	13.74	13.68	18.15	13.64	16.08	13.58	14.07	14.29	17.39	14.28	14.89
a27	4.66	3.92	7.26	5.16	4.14	5.24	6.23	6.18	5.47	4.5	5.276
a28	6.17	7.74	7.08	5.99	6.09	5.35	6.22	5.58	7.93	7.97	6.612
a29	4.93	5.84	5.83	5.52	4.67	4.93	4.98	6.52	4.3	5.05	5.257
a30	4.93	5.84	5.83	5.52	4.67	4.93	4.98	6.52	4.3	5.05	5.257
a31	5.53	3.61	4.64	4.57	4.5	4.24	6	5.72	5.21	3.85	4.787
a32	12.17	10.72	12.52	11.72	10.93	9.88	12.45	11.64	11.55	12.97	11.655
a33	4.3	6.76	6.17	6.56	4.87	4.93	7.63	6.27	4.78	5.56	5.783
a34	2.56	2.57	3.01	2.61	3.47	2.98	2.79	1.12	3.2	2.07	2.638
a35	94.76	94	103.3	88.3	94.82	94.78	103.6	91.54	99.52	91.64	95.634
a36	11.42	13.5	14.7	14.96	17.18	13.68	15.72	18.1	14.44	17.16	15.086
a37	22.5	22.38	19.96	15.66	18.76	17.5	13.1	16.24	14.38	19.56	18.004
a38	13.02	18.42	18.72	9.44	20.2	15.08	16.94	13.58	25.38	25.24	17.602
a39	103.8	153.6	138.9	114.4	110.2	104.1	95.84	128.1	159.2	143.82	125.23
a40	125.4	177.6	92.26	99.58	154.1	124.7	126.5	93	102.3	135.02	123.06
a41	159	133.6	142.2	118.8	113.3	130.9	117.7	146.2	139.2	120.58	132.18
a42	10.98	18.18	11.4	11.62	14.56	8.7	11.3	16.42	12.86	13.14	12.916
a43	9.44	8.52	10.6	9.34	8.02	10.1	8.6	63.84	8.2	10.42	14.708
a44	20.56	15.94	18.74	18.16	20.82	18.84	13.72	19.92	17.62	12.56	17.688
a45	82.08	108.1	95.47	144.4	96.68	149.9	114	111.5	134.8	134.23	117.16

A look at Table 2indicates the maximum time required for the activity to be performed during the preparation of the report.Figure 3 represents the average time of each activity graphically.

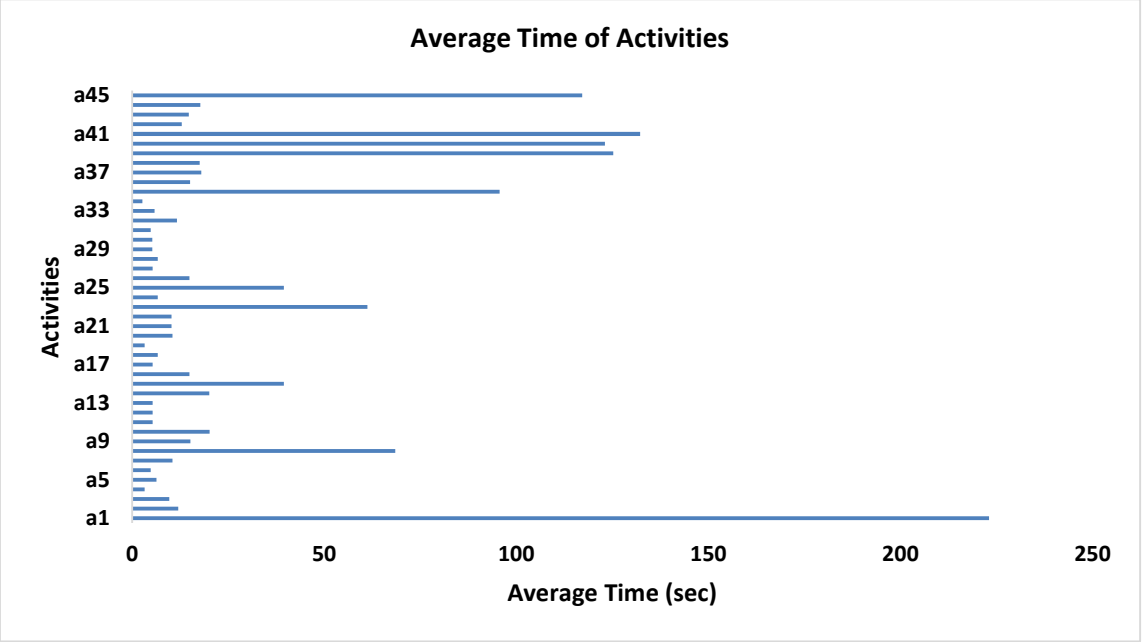


Figure 3. The average time the various tasks are performed to prepare the post-order costing report

Time Required to Make the report Manually

The time for manual preparation of the post-order costing analysis report can be calculated accordingly below-given calculations.

$$D=a1+a2+a3+a4+a5+a6+a7+a8+a9+a10+a11+a12+a13+a14+a15+a16+a17+a18+a19+a20+a21+a23+a24+a25+a26+a27+a28$$

$$D = 633.401 \text{ sec}$$

$$E = a22+a29+a30+a31+a32+a33+a34+a35+a36+a37+a38+a39+a40+a41+a42+a43+a44+a45$$

$$E = 734.865 \text{ sec}$$

Where

D= Time required to prepare the data for summary

E= Time required to complete the summary of one article

n= Number of articles for which the summary is to be made

$$T = D + E \times n$$
$$T = 633.401 + 734.865n$$

Calculations

The equations used in the calculation of actual material cost and the labor cost are discussed in the below-given headings.

Material Cost

The post-order material cost includes a leather cost (1), shoe material cost (2), and total material cost (3). Furthermore, for more analysis, material cost per pair (4), a difference of estimated and incurred material cost (5), excess/short of leather quantity(6), and shoe material quantity (7) used in the article were used to be calculated to depict the profit/loss in the order. Moreover, the post-order analysis of any order included the cost variance i.e. leather material cost variance (8), shoe material cost variance (9), and total material cost variance (10).

$$ALM_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{i=1}^{n}(CQ_{ijk}C_{ijk}) \quad (1)$$

$$ASM_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{h=1}^{p}(CQ_{hjk}C_{hjk}) \quad (2)$$

$$ATM_c = (ALM_c + ASM_c) \quad (3)$$

$$AMCPP = \frac{ATM_c}{OV} \quad (4)$$

$$DMCPP = \frac{ATM_c - ETM_c}{OV} \quad (5)$$

$$DLMQ = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{i=1}^{n}(CQ_{ijk} - EQ_{ijk}) \quad (6)$$

$$DSMQ = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{h=1}^{p}(CQ_{hjk} - EQ_{hjk}) \quad (7)$$

$$CVLM = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{i=1}^{n} CQ_{ijk}(CQ_{ijk} - EQ_{ijk}) \quad (8)$$

$$CVSM = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{h=1}^{p} C_{hjk}\left(CQ_{hjk} - EQ_{hjk}\right) \quad (9)$$

$$TMCV = CVLM + CVSM \quad (10)$$

Actual Labor Cost

Actual labor costs included the actual costs of cutting (11), stitching (12), lasting (13), molding (14), hand stitching (15), job work (16), total labor cost (17), and actual labor cost per pair (18). Moreover, post-order cost analysis included the difference between estimated labor cost and actual labor cost (19), the total actual cost of the article (20), the total actual cost per pair (21), and the difference between the estimated and actual cost per pair (22).

$$AC_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{o=1}^{q}(AT_{ojk}Cs) \quad (11)$$

$$AS_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{s=1}^{r}(AT_{sjk}Cs) \quad (12)$$

$$AL_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{g=1}^{L}(AT_{gjk}Cs) \quad (13)$$

$$AM_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{v=1}^{w}(AT_{vjk}Cs) \quad (14)$$

$$AHS_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{t=1}^{u}(AT_{tjk}Cs) \quad (15)$$

$$AJW_c = \sum_{k=1}^{m}\sum_{j=1}^{m}\sum_{x=1}^{y}(AT_{xjk}Cs) \quad (16)$$

$$ATL_c = (AC_c + AS_c + AL_c + AM_c + AHS_c + AJW_c) \quad (17)$$

$$ALCPP = \frac{ATL_c}{OV} \quad (18)$$

$$\text{DLCPP} = \frac{ATL_c - ATL_c}{OV} \quad (19)$$

$$ATC = (ATM_c + ATL_c + TO + TTC + BPC) \quad (20)$$

$$ATCPP = \frac{ATC}{OV} \quad (21)$$

$$DTCPP = \frac{ATC - ETC}{OV} \quad (22)$$

Suggested Method for Preparation of Post-Order Costing Analysis Report

Worksheets and their Purpose in Automated Template

Nine worksheets are necessary for the automated template to work properly. All the worksheets are linked to one another, and the data from various sheets are fetched at different levels during the report formation.When the transaction is downloaded from Microsoft AX Dynamics and copied into the OPOC template, it keeps its backup in the transaction backup worksheet (see appendix 1) so that in case of human error or mistake, the transaction data can easily be copied from the transaction back and carried on with the reporting without wasting any time. In the manual method, the employee used to track the number of shoe boxes in the list of quantified material requirements but in the automated template, the articles and their ordered quantity were easily taken out by executing a pivotable using macros.

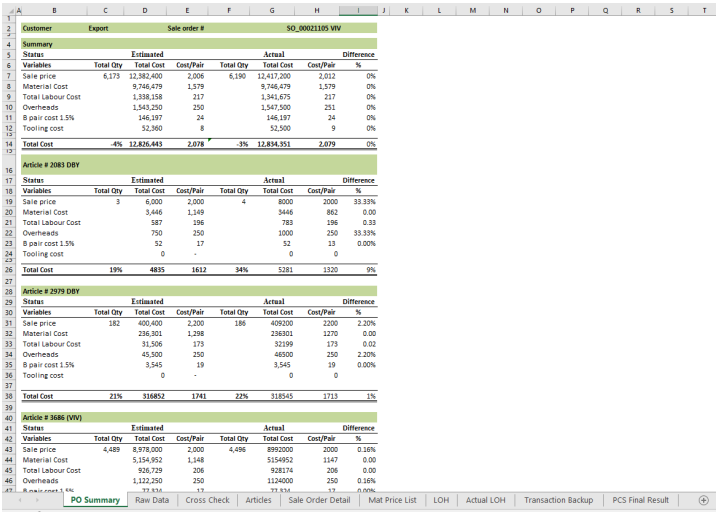
Worksheet named *articles* (see appendix 2) is used to reveal the number of articles, their colors and their pairs to be produced by using the data given in the *sale order detail* worksheet (see appendix 4).

In the worksheet named *raw data* (see appendix 3), the detailed post-order costing report is processed and formed; the *raw data* worksheet fetches data from various worksheets as given in Figure 5. As per the manual method, the employee was supposed to fetch the article numbers (registered against the production numbers) of various articles from the sale order detail workbook (activities a8 and a9 as given inTable 2).

Whereas in the automated template, the separate worksheet is inserted with name sale order detail (see appendix 4). In this worksheet, the production numbers (the data which is downloaded from the Microsoft AX Dynamics does not include the article number, it only includes the production number; thus the article numbers are fetched from this worksheet against the production numbers in Raw data worksheet) of various articles of the same/different colors are stored in this worksheet. As per the manual method, the prices of the various materials were fetched from the separate workbook containing the prices of various materials. In the contrast to the manual method, the prices of various materials in the automated template are stored in the *mat price list* worksheet (see appendix 5) and the prices are used in the report formation as given in the *raw data* worksheet (see appendix 3).

The employee used to calculate the various costs (labor cost (*a39*), tooling cost (*a40*), and overheads (*a41*)) manually in the existing method but the automated template contains a separate worksheet (named *LOH*) to store the data associated with the mentioned costs. Worksheet named *LOH* (see appendix 6), the name is abbreviated as labor and overheads (LOH); in this worksheet, estimated labor costs associated with all the production departments (cutting, stitching, and lasting) and overheads of every article are stored and are used in the *PO summary* worksheet (seeFigure 4). Since the post-order costing report is about the calculation of the real-time cost of an article and the *LOH* worksheet contained the estimated costs. Therefore, it was required to insert another worksheet containing the real-time labor cost, tooling cost, and overheads so that the time incurred on the manual fetching of data could be eliminated. In this regard, the worksheet was inserted and named as *actual LOH.*

The actual LOH worksheet (see appendix 7) consists of the values of actual labor costs and overheads incurred on the article in real-time during production. The available data in the *actual LOH* worksheet is used in the *PO summary*. *PCS final results* worksheet (see appendix 8) consists of the data which was obtained from the estimated order costing report as discussed in a previously published research paper (Kalwar, Shahzad, et al., 2022).



Customer	Export			Sale order #			SO_00021105 VIV	
Summary								
Status		Estimated			Actual			Difference
Variables	Total Qty	Total Cost	Cost/Pair	Total Qty	Total Cost	Cost/Pair		%
Sale price	6,173	12,382,400	2,006	6,190	12,417,200	2,012		0%
Material Cost		9,746,479	1,579		9,746,479	1,579		0%
Total Labour Cost		1,338,158	217		1,341,675	217		0%
Overheads		1,543,250	250		1,547,500	251		0%
B pair cost 1.5%		146,197	24		146,197	24		0%
Tooling cost		52,360	8		52,500	9		0%
Total Cost	-4%	12,826,443	2,078	-3%	12,834,351	2,079		0%
Article # 2083 DBY								
Status		Estimated			Actual			Difference
Variables	Total Qty	Total Cost	Cost/Pair	Total Qty	Total Cost	Cost/Pair		%
Sale price	3	6,000	2,000	4	8000	2000		33.33%
Material Cost		3,446	1,149		3446	862		0.00
Total Labour Cost		587	196		783	196		0.33
Overheads		750	250		1000	250		33.33%
B pair cost 1.5%		52	17		52	13		0.00%
Tooling cost		0	-		0	0		
Total Cost	19%	4835	1612	34%	5281	1320		9%
Article # 2979 DBY								
Status		Estimated			Actual			Difference
Variables	Total Qty	Total Cost	Cost/Pair	Total Qty	Total Cost	Cost/Pair		%
Sale price	182	400,400	2,200	186	409200	2200		2.20%
Material Cost		236,301	1,298		236301	1270		0.00
Total Labour Cost		31,506	173		32199	173		0.02
Overheads		45,500	250		46500	250		2.20%
B pair cost 1.5%		3,545	19		3,545	19		0.00%
Tooling cost		0	-		0	0		
Total Cost	21%	316852	1741	22%	318545	1713		1%
Article # 3686 (VIV)								
Status		Estimated			Actual			Difference
Variables	Total Qty	Total Cost	Cost/Pair	Total Qty	Total Cost	Cost/Pair		%
Sale price	4,489	8,978,000	2,000	4,496	8992000	2000		0.16%
Material Cost		5,154,952	1,148		5154952	1147		0.00
Total Labour Cost		926,729	206		928174	206		0.00
Overheads		1,122,250	250		1124000	250		0.16%

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Figure 4. 'PO Summary' worksheet required in order and post-order costing (OPOC) template

PO summary worksheet (seeFigure4) is used for the calculation of summarized estimated costs and the costs incurred in real-time during the production.

Data Fetching Across Various Worksheets

The figure is the representation of links among various worksheets in terms of automated accessing data. At the very first, the downloaded data from Microsoft AX dynamics is pasted into the *raw data* worksheet of the OPOC template and in case of any mistake in the execution of the report, it is supposed to be copied from the *transaction backup* worksheet. In the second step, articles of various colors along with their quantities to be produced are taken out in the *articles* worksheet by using the data available in the raw data and sale order detail worksheets. The third step is to start organizing data for post-order costing analysis, in this step, the costs of material i.e. leather and shoe material are required that are fetched from the *mat price list* worksheet (seeFigure 5).

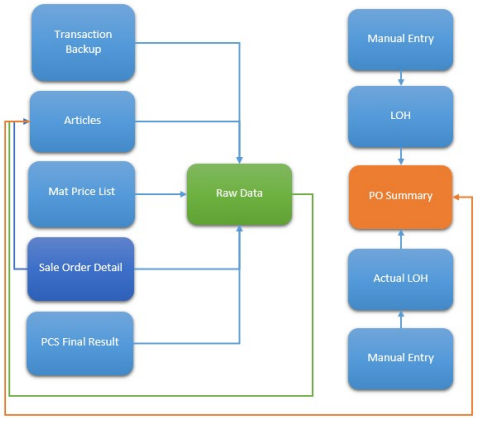


Figure 5. Representation of data fetching among the worksheets of OPOC template

In the fourth step, after the automated preparation of the post-order costing analysis report in the raw data worksheet, some values of total costs i.e. leather and shoe material cost of articles and the row index of totals are automatically put into the *articles* worksheet. When the analysis required in the raw data worksheet is once finished then the employee was supposed to start working on the summary of the report in the *PO summary* worksheet (seeFigure 4). Estimated and actual labor costs and overheads are fetched from LOH and actual LOH (which are manually put into both worksheets) respectively. Moreover, the material cost and price of various articles are taken from the *articles* worksheet.

The function of Automated Template

Post-order costing was made using a manual process, including calculation, data organization, and report formation. Manual procedure increased the likelihood of error and it used to take a lot of staff time to find and fix that error. The personnel becomes irritated and frustrated while performing repetitive tasks and error repair. Due to the above-mentioned causes, automation was emphasized in the post-order costing repot. To run the macros used in the automation of the abovementioned report, two user forms were created.

Userform (given inFigure 6) can be opened by pressing Ctrl + q.When this form appears, the user is required to select (options given in the combo-box) the type of report he wants to make and clicks the command button ‘Go’; it will lead the user to another form given inFigure 7.

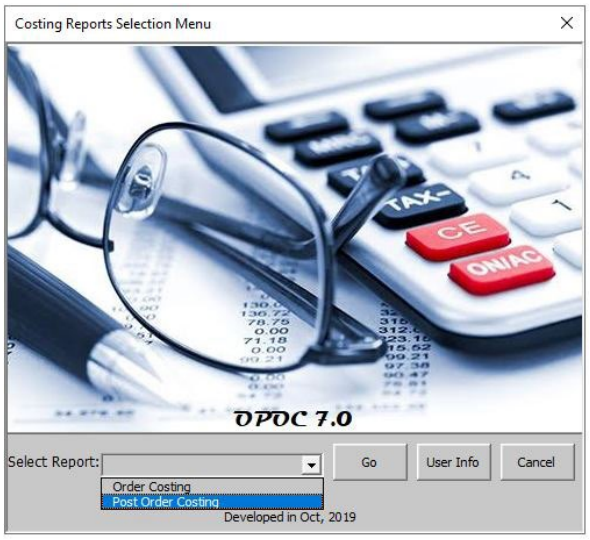


Figure 6. Userform leading to the commands (macros) for making the order costing report.

Userform presented in Figure 7is consisted of the command buttons having macros at their back which are supposed to be executed with just one click.

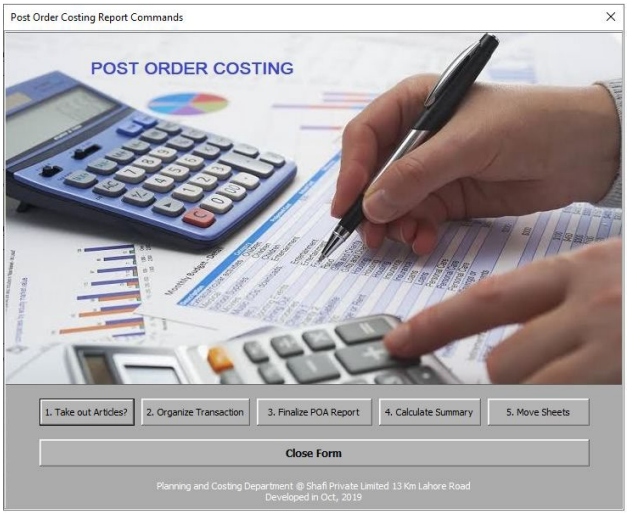


Figure 7. Commands menu for preparation of the order costing report

Macros at the Back of Each Command Button

The whole VBA code was long consisting of around 2000 lines, therefore it was split into 20 macros (containing small portions of code). Four command buttons were inserted in the userform (seeFigure 7); the output and sequence of programmed macros at the back-end of command button are discussed in the below-given headings.

Take Out Articles

After the transaction is pasted into the *raw data* worksheet, '*take out articles'* (seeFigure 7) is the first command button that is pressed to initiate the post-order costing report. At the back of this command button, only one macro is programmed i.e. *TakeOutArticles.* The purpose of the programmed macro is to take out the articles of various colors and their pairs to be produced (seeFigure 8).

Figure 8. The sequence of running of macros at the back of the command button

Afterexecution of the macro, the *raw data* worksheet is selected and the command button is disabled to avoid double execution of the macro. The obtained output after the execution of this command button is given in appendix 2. In the manual making of the post-order costing report, the articles and their quantity was supposed to be taken out manually and the employee had to the apply the filters to do it.As far as the automated feature of the template is concerned, the articles and their quantity are taken out in just 1.421 seconds (see Table 3).

Organize Transaction

After the articles are taken out, post-order costing analysis is completed by clicking two command buttons i.e. *'organize transaction'* and *'finalize POA report'*. The sequence of macros, that are supposed to be executed when *'organize transaction'* is clicked is given in Figure 9.

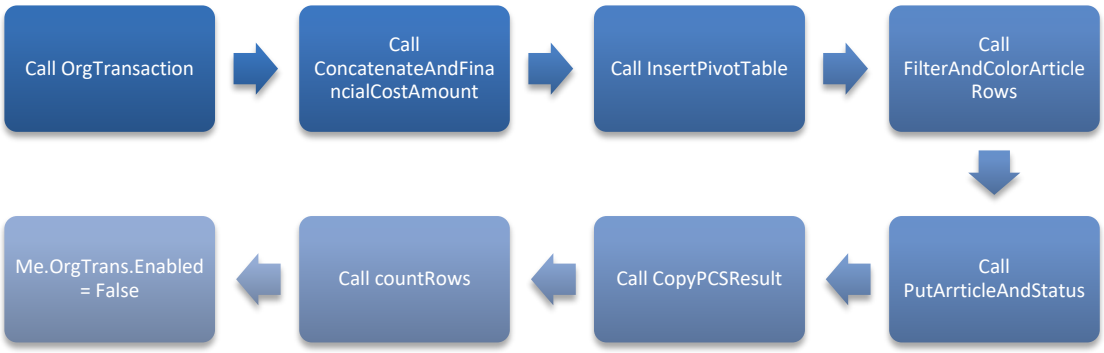
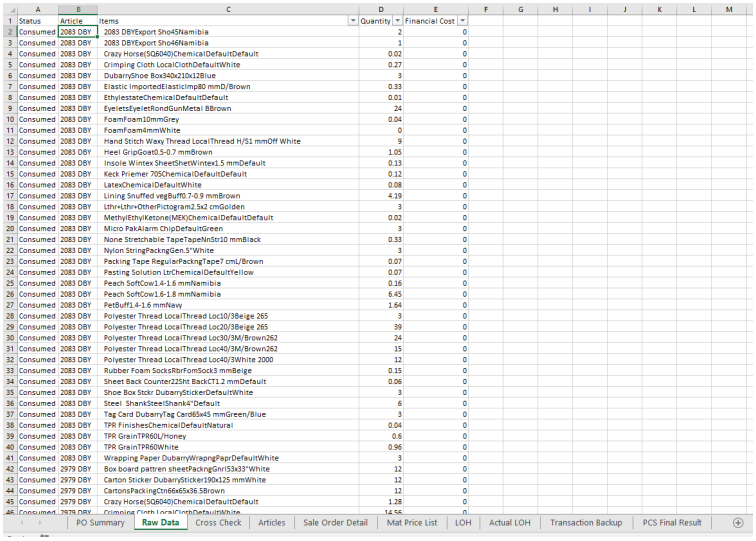


Figure 9. The sequence of running of macros at the back of the command button

The obtained output after the execution of all the macros at the back of this command button is given in Figure 10. The activities from *a2* to *a21*as given in Figure 2 and Table 2 take an average time of 276.3 seconds (4.605 minutes). These activities were programmed by using VBA in the form of macros and the macros (as given in each of the boxes given in Figure 9) were called for execution when *organize transaction* command button is clicked. Since 4.605 minutes are saved by this template on one article and if the articles are more than one then the magnitude of saved time will increase accordingly.



Status	Article	Items	Quantity	Financial Cost
Consumed	2083 DBY	2083 DBYExport Sho45Namibia	2	0
Consumed	2083 DBY	2083 DBYExport Sho46Namibia	1	0
Consumed	2083 DBY	Crazy Horse(SQ6040)ChemicalDefaultDefault	0.02	0
Consumed	2083 DBY	Crimping Cloth LocalClothDefaultWhite	0.27	0
Consumed	2083 DBY	DubarryShoe Box340x210x128lue	3	0
Consumed	2083 DBY	Elastic ImportedElasticImp80 mmD/Brown	0.33	0
Consumed	2083 DBY	EthylestateChemicalDefaultDefault	0.01	0
Consumed	2083 DBY	EyeletsEyeletRondGunMetal 8Brown	24	0
Consumed	2083 DBY	FoamFoam10mmGrey	0.04	0
Consumed	2083 DBY	FoamFoam4mmWhite	0	0
Consumed	2083 DBY	Hand Stitch Waxy Thread LocalThread H/S1 mmOff White	9	0
Consumed	2083 DBY	Heel GripGoat0.5-0.7 mmBrown	1.05	0
Consumed	2083 DBY	Insole Wintex SheetShetWintex1.5 mmDefault	0.13	0
Consumed	2083 DBY	Keck Primer 705ChemicalDefaultDefault	0.12	0
Consumed	2083 DBY	LatexChemicalDefaultWhite	0.08	0
Consumed	2083 DBY	Lining Snuffed vegBuff0.7-0.9 mmBrown	4.19	0
Consumed	2083 DBY	Lthr+Lthr+OtherPictogram2.5x2 cmGolden	3	0
Consumed	2083 DBY	MethylEthylKetone(MEK)ChemicalDefaultDefault	0.02	0
Consumed	2083 DBY	Micro PakAlarm ChipDefaultGreen	3	0
Consumed	2083 DBY	None Stretchable TapeTapeNnStr10 mmBlack	0.33	0
Consumed	2083 DBY	Nylon StringPackngGen.5"White	3	0
Consumed	2083 DBY	Packing Tape RegularPackngTape7 cmL/Brown	0.07	0
Consumed	2083 DBY	Pasting Solution LtrChemicalDefaultYellow	0.07	0
Consumed	2083 DBY	Peach SoftCow1.4-1.6 mmNamibia	0.16	0
Consumed	2083 DBY	Peach SoftCow1.6-1.8 mmNamibia	6.45	0
Consumed	2083 DBY	PetBuff1.4-1.6 mmNavy	1.64	0
Consumed	2083 DBY	Polyester Thread LocalThread Loc10/3Beige 265	3	0
Consumed	2083 DBY	Polyester Thread LocalThread Loc20/3Beige 265	39	0
Consumed	2083 DBY	Polyester Thread LocalThread Loc30/3M/Brown262	24	0
Consumed	2083 DBY	Polyester Thread LocalThread Loc40/3M/Brown262	15	0
Consumed	2083 DBY	Polyester Thread LocalThread Loc40/3White 2000	12	0
Consumed	2083 DBY	Rubber Foam SocksRorFomSock3 mmBeige	0.15	0
Consumed	2083 DBY	Sheet Back Counter225ht BackCT1.2 mmDefault	0.06	0
Consumed	2083 DBY	Shoe Box Stckr DubarryStickerDefaultWhite	3	0
Consumed	2083 DBY	Steel ShankSteelShank4"Default	6	0
Consumed	2083 DBY	Tag Card DubarryTag Cerd65x45 mmGreen/Blue	3	0
Consumed	2083 DBY	TPR FinishesChemicalDefaultNatural	0.04	0
Consumed	2083 DBY	TPR GrainTPR60L/Honey	0.6	0
Consumed	2083 DBY	TPR GrainTPR60White	0.96	0
Consumed	2083 DBY	Wrapping Paper DubarryWrapngPaprDefaultWhite	3	0
Consumed	2979 DBY	Box board pattren sheetPackngGnr53x33"White	12	0
Consumed	2979 DBY	Carton Sticker DubarrySticker190x125 mmWhite	12	0
Consumed	2979 DBY	CartonsPackingCtn66x65x36.5Brown	12	0
Consumed	2979 DBY	Crazy Horse(SQ6040)ChemicalDefaultDefault	1.28	0
Consumed	2979 DBY	Crimping Cloth LocalClothDefaultWhite	14.56	0

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Figure 10. Output in OPOC template after running macros

Finalize POA Report

The detailed post-order costing analysis report as given in appendix 3 is prepared in the *raw data* worksheet after clicking the *finalize POA report*; the sequence of macros that are supposed to be executed after clicking it is given in Figure 11 shown below.

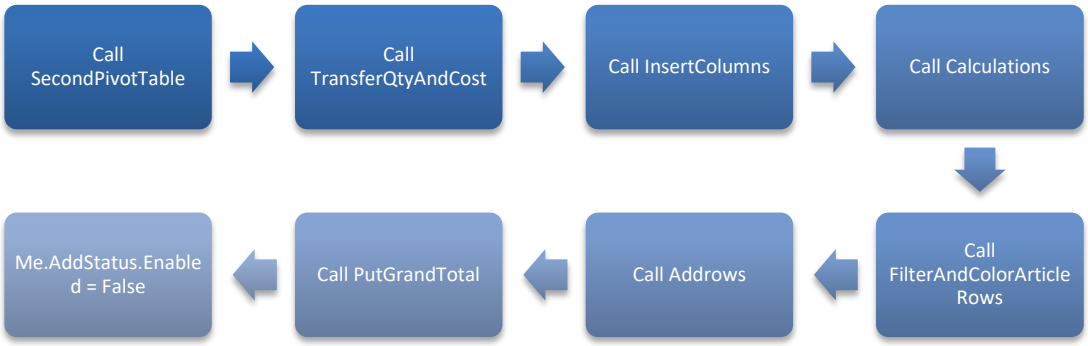


Figure 11. The sequence of running of macros at the back of the command button

The activities from *a22* to *a34*as given in Figure 2 and Table 2 take an average time of 197.665 seconds (2.994 minutes). The mentionedactivities were programmed by using VBA in the form of macros and the macros (as given in each of the boxes given inFigure 11) were called for execution when *finalize POA report*command button is clicked. Since 2.994 minutes are saved by this template on one article and if the articles are more than one then the magnitude of saved time will increase accordingly.

Calculate Summary

The command button i.e. *calculates summary* consists of two macros i.e. *TransferArticlesDetails* and *PostOrderSummary* (seeFigure 12) and then the clicked command button is disabled to avoid double clicking. The obtained output after clicking the command button is given inFigure 4. The summary in the manual method was used to be made after the manual calculations performed either in Microsoft Excel or a calculator; the manual calculations (estimated and actual labor cost, tooling cost, overheads, B-pair cost, cost per pair, and insertion of article pictures in the summary) used to take 11.488 minutes of the employee to complete the summary of the report.

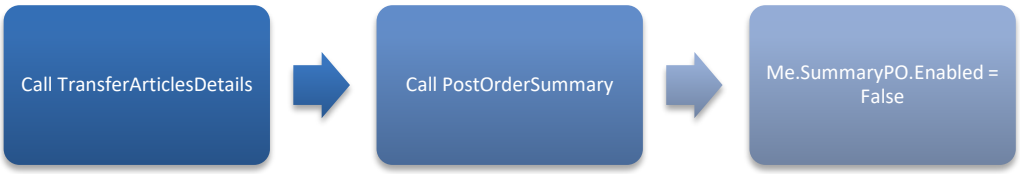


Figure 12. The sequence of running of macros at the back of the command button

The tasks from *a35* to *a45*as given in Figure 2 and Table 2 take an average time of 689.287 seconds (11.488 minutes). The mentioned activities were programmed by using VBA in the form of macros and the macros (as given in each of the boxes given inFigure 12) were called for execution when *calculate summary*command button is clicked. Since 11.488 minutes are saved by this template on one article and if the articles are more than one then the magnitude of saved time will increase accordingly.

Move Sheets

The post-order costing analysis report was supposed to be sent to the manager supply chain via mail. Since the file of the OPOC template was of greater size i.e. 10 MB or even more; thus it was required to send only necessary worksheets to him, this was the reason, this command button was initiated. With the use of this command button, two worksheets i.e. *raw data* and *PO summary* were used to be transferred to the new workbook and that particular book was used to be sent to the manager. The code of the macro behind this command button.

Time Required to Conduct Post_Order Costing Analysis

The execution time of preparing a post-order costing analysis report via OPOC template, took 230.152 seconds or 3.84 minutes as given inTable 3.

Table 3. Average time of execution of each activity in the OPOC template

Activity	Average Time (sec)
Download the transaction from Microsoft AX Dynamics	223.014
Execution of command button: Articles	1.421
Execution of command button: Organize Transaction	2.33
Execution of command button: Finalize POA Report	1.56
Execution of command button: Calculate Summary	0.982
Execution of command button: Move Sheets	0.845
Total	230.152

Comparison of Old And Suggested Methods

A comparison of time taken by both methods i.e. manual and OPOC template to make post-order costing report analysis revealed that the manual post-order costing report for one article used took 1368.266 sec = 22.80 minutes; whereas, the report via OPOC template took 230.152 sec = 3.84 minutes. The suggested method saved 83.18% of employees' time used to be spent on making these reports for different articles.

Facts and Findings

Since the comparison of both of the methods indicated that the automated method saved 83.18% of the employee that was used to be spent on the report generation of post-order costing. The workload of the employee in terms of the time spent on the report was minimized significantly, therefore, the employees can be instructed for further tasks and trained accordingly. This practice would lead to increased employee satisfaction and so the increased reporting efficiency of the department.

The Change Management

When it is about to bring about the change in the daily routine work, people show reluctance to embrace the change therefore, during the conduct of the present research, employees were got mentally prepared for the change that had to happen shortly in terms of the automated post-order costing report. It took the authors 14 days to implement the report because of the repeated mistakes made by the employee during the report generation. In that scenario, the employee had technical support in case of any error in the report or the solution to the mistake made by him. In this regard, it was very convenient to bring about the change otherwise it would be very difficult in the absence of technical and moral support.

Discussion

Every small and medium business hires an employee to create excel reports on a daily, monthly,quarterly, and annual basis. Employees must spend too much time performing manual excel operations, and manual work carries a higher risk of errors. In this regard, the software provider has maintained capability in office programs like word, excel, and PowerPoint as well as MS projects, etc. Therefore, Microsoft created VBA, ActiveX, VSTO, and many more technologies in response to user demands (Ding et al., 2017)(Porter & Stretcher, 2012). Numerous software programs on to windows platform support VBA technology (Kuka & Karamani, 2011)(Norton & Tiwari, 2013)(Harahap & Azmi, 2017).Nowadays, companies encourage their staff to develop their knowledge and proficiency with VBA Excel (Chatvichiencha, 2015). The integrated development environment (IDE) in office applications is used around where VBA technology is developed and customized. This allows for the automation and simplification of difficult and repetitive tasks, respectively (Ding et al., 2017)(Evensen, 2014)(Minto, 2009)(Harahap & Azmi, 2017)(Kuka & Karamani, 2011). The routine tasks carried out by current office productivity software using in automated (Ding et al., 2017)(Chatvichiencha, 2015). The goal of the current study was to completely automate all manual processes including the creation of the report. In VBA, user input is collected using user forms (Evensen, 2014). In the current work, the author used a combo box on the tothe userfrom to collect input from the user (the report he wants to work on). To carry out the duties automatically, the user form may also have a code and actions (Evensen, 2014)(Harahap & Azmi, 2017)(Kalwar & Khan, 2020b). Two userforms are created with command buttons that have macros at their backs to instantly carry out the programmed tasks (each macro for each task), just like in the order costing report.The procedure for data migration and analysis was developed and implemented by Bartoszewicz and Wdowicz (2019) using VBA, which was more flexible and quick, and with the help of which the entire process of the complex report was spent up (operation time reduces from 2 hours to 5 minutes) (Bartoszewicz & Wdowicz, 2019). With the use of VBA in excel, Cirujano and Zhu (2013) automated the human power resource planning report. The manual report; if it were created by an un experienced reporter used to take 30 working hours, but after automation it takes 10 minutes (99.4% less time)(Cirujano & Zhu, 2013). Seventy five percent (75%) of the time that employees would have spent manually creating the procurement report was saved by Kalwar and Khan (2020) (Kalwar & Khan, 2020b). In the same way, post order costing report takes 8318% with automation compared to manual method. Yan and Wan (2017) created an application using excel VBA for the automatic computation and development of a transmission line's bill of materials (BOM). The design and use of the templates considerably increase efficiency and accuracy while lowering errors during the production of the whole steel BOM (Yan & Wan, 2017).WQI and API were automatically estimated by Abidin et al., (2013) using VBA. The application offered a useful method for calculating WQI and API, and the automation decreased computation time and error (Abidin et al., 2015). Similar to the order costing report, the likelihood of error is zero; provided the input data that was accurate then there was no need to be concerned about errors in the outcomes.

Kalwar and Khan (2020) worked on the framework for the automation of procurement and purchase order report preparation reports by using visual basic for applications (VBA) in Microsoft Excel. The procurement decision-making logic was worked in the research (Kalwar & Khan, 2020b). Kalwar et al. (2022) aimed to develop the framework for the automation of the order costing report (the term order costing refers to the calculation of estimated footwear article cost which was supposed to be calculated before the

start of the production of the ordered footwear articles) was carried out in their research paper. The mentioned report was used to be prepared manually in Microsoft Excel. The framework of various equations was also framed and VBA was used to automate the report (Kalwar, Shahzad, et al., 2022).

The work presented in (Kalwar & Khan, 2020b) is entirely different from the present research. Current work is the next official step of order costing that was presented in (Kalwar, Shahzad, et al., 2022). Post-order costing refers to the actual cost of the article that incurs on the article during production; sometimes the post-order cost exceeds the estimated costs and sometimes it comes lower. In the present research paper, the post-order costing framework has been designed and the report has been automated by using VBA. The designed equations and automation mechanism is framed in detail along with the used VBA code in appendices.No, research was found to carryout automated reporting in Microsoft Excel and which is perfectly designed to automatedly make the report in such a way as if is manually prepared by an expert employee. The contribution of the present research is that it provides a detailed way to go with automation in routine office work; by which a tremendous amount of the employee's time can be saved with countable efforts.

Conclusion

To verify the template's accuracy and authenticity, a report was prepared using a variety of articles and colors. The suggested method was implemented over the course of a month, the length of time was due to the need for troubleshooting and calculating validation. Due to formatting and calculation problems, the templates were changed 50 times over the implementation period. The post-order costing report queues at the costing department were reduced to zero when the suggested solution was put into practice. The user was instructed to download the data from Microsoft Dynamics AX after using the suggested approach, and collect the costs of various items and the standard allowed minutes (SAMs) of cutting and stitching specific items. After the mentioned date he was only required to access the template and click the command buttons on the user forms to finish the report. The user was driven to apply the suggested technique for creating the post-order costing report due to its accuracy and time-saving qualities. In this regard, the suggested approach would e conveniently taught and used by the new users due to its user-friendliness and straightforward interface. It was extremely difficult for the new employee to understand and generate the order costing report.

Future Implication

The user who used the template was not educated enough to edit any error in the code. The researcher volunteered his services to teach VBA, but busy schedule, no one could have learned about the subject. At the same time, no one in the entire company was knowledgeable enough to deal with VBA. Although the template is still error-free, there remains a chance (even if it is quite less).

Managerial Implications

Since the comparison of both of the methods indicated that the automated method saved 83.18% of the employee that was used to be spent on the report generation of post-order costing. The present report was automated just to decrease the workload of the employee so that he could have some time to improve his skill set but due to the automation, the workload of the employee increased significantly. This aspect is reported to be the drawback of report automation in developing countries like Pakistan.

Limitations

The suggested method takes a decent amount of time for small order, such as 100-40000 pairs with 20 colors, but when the order exceeds the specified range, it takes too long to finish the report. This is due to a longer range of rows processing an excessive amount of data. MS Excel will undoubtedly be slow when the data is large and the procedure is lengthy because it is little application compared to a database like SQL Server and Oracle. This is the automatic order costing template's major drawback.

Future Work

It will be easier to start the order costing model in Microsoft Dynamics AX because it was already said, the suggested technique takes too long time when the data is large. If this occurs, employees will save time because different departments will be integrated (i.e. production, sale, purchasing, and planning) in a convenient manner.

Conflict of Interests

This research article's authors declared no potential conflicts of interest in line with the research, authorship, and publication.

Funding Statement

The authors received no financial support for the research and authorship of this research article.

References

Abidin, I. Z., Juahir, H., Azid, A., Mustafa, A. D., & Azaman, F. (2015). Application of Excel-VBA for computation of water quality index and air pollutant index. *Malaysian Journal of Analytical Sciences*, *19*(5), 1056–1064.

Abraham, R., Burnett, M., & Erwig, M. (2008). Spreadsheet Programming. In *Wiley Encyclopedia of Computer Science and Engineering*.

Ahmadi, A., Robinson, P. H., Elizondo, F., & Chilibroste, P. (2018). Implementation of CTR dairy model using the visual basic for application language of Microsoft excel. *International Journal of Agricultural and Environmental Information Systems*, *9*(3), 74–86. https://doi.org/10.4018/IJAEIS.2018070105

Balson, D. (2012). User Defined Spreadsheet Functions in Excel. *Proceedings of EuSpRIG 2012 Conference "The Science of Spreadsheet Risk Management*.

Bartoszewicz, G., & Wdowicz, M. (2019). Automation of the Process of Reporting the Compliance of the Production Plan with Its Execution Based on Integration of SAP ERP System In Connection With Excel Spreadsheet and VBA Application. In *Digitalization of Supply Chains*. https://doi.org/10.17270/b.m.978-83-66017-86-3

Belchior Junior, A., Bruel, R. N., Andrade, D. A., Sabundjian, G., Macedo, L. A., Angelo, G., Torres, W. M., Umbehaun, P. E., & Conti, T. N. (2011). Development of a Vba Macro-Based Spreadsheet Application for Relap5 Data Post-Processing. *International Nuclear Atlantic Conference*, 978–985.

Blattner, D. E., & Valrico, F. (2007). *Automatic Report Generation* (Patent No. US 2007/0055688 A1).

Blayney, P. J., & Sun, Z. (2019). Using Excel and Excel VBA for Preliminary Analysis in Big Data Research. In *Managerial Perspectives on Intelligent Big Data Analytics. IGI Global* (Issue March, pp. 110–136). https://doi.org/10.4018/978-1-5225-7277-0.ch007

Botchkarev, A. (2015). *Assessing Excel VBA Suitability for Monte Carlo Simulation*. 1–30.

Broman, K. W., Woo, K. H., & Woo, K. H. (2017). *Data organization in spreadsheets Data organization in spreadsheets and* (Vol. 1305). https://doi.org/10.1080/00031305.2017.1375989

Bukhsh, M., Khan, M. A., Zaidi, I. H., Yaseen, R., Khalid, A., Razzaque, A., & Ali, M. (2021). Productivity Improvement in Textile Industry using Lean Manufacturing Practice of Single Minute Die Exchange (SMED). *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management Singapore, March 7-11, 2021*. http://www.ieomsociety.org/singapore2021/papers/1282.pdf

Chatvichiencha, S. (2015). Enhancing Computational Thinking by Excel-VBA Based Problem Solving. *The 2nd International Conference on Innovation in Education*, 284–290.

Chaudhry, A. K., Kalwar, M. A., Khan, M. A., & Shaikh, S. A. (2021). Improving the Efficiency of Small Management Information System by Using VBA. *International Journal of Science and Engineering Investigations*, *10*(111), 7–13. http://www.ijsei.com/papers/ijsei-1011121-02.pdf

Cirujano, J., & Zhu, Z. (2013). Automatic reporting for manpower resources. *Proceedings, Annual Conference - Canadian Society for Civil Engineering*, *1*(January), 710–719.

Ding, H.-L., Qi, K.-Y., Zhaq, X.-L., & Xu, G.-F. (2017). Tibetan Typographical Specifications and Technical Realization Based on Word VBA. *4th International Conference on Advanced Education and Management*, 407–412. https://doi.org/10.12783/dtssehs/icaem2017/19117

Dunn, A. (2009). Automated Spreadsheet Development. In *arXiv preprint arXiv* (pp. 908–928).

Evensen, H. T. (2014). A versatile platform for programming and data acquisition: Excel and Visual Basic for Applications. *ASEE Annual Conference and Exposition*.

Fisher, M., Cao, M., Rothermel, G., Cook, C. R., & Burnett, M. M. (2002). Automated Test Case Generation for Spreadsheets. *24th International Conference on Software Engineering*, 141–153.

George, T. (2023). *What Is Action Research? | Definition & Examples*. Scribbr.

Harahap, M. I. P., & Azmi, M. H. (2017). Development of Excel Vba Program for Small Drainage Network. *E-Academia Journal*, *6*(1), 216–227.

Hila, R. (2009). Water Quality Data Management Database. In *Society*.

Iftikhar, Z., Khan, M. A., Kumar, R., Bux, K., & Haseeb, A. (2021). Productivity Improvement of Garments Industry by Assembly Line Technique of Lean Manufacturing. *Proceedings (Abstract) of the International Conference on Industrial & Mechanical Engineering and Operations Management Dhaka, Bangladesh, December 26-27, 2021.*, 908. https://ieomsociety.org/proceedings/2021dhaka/497.pdf

Iftikhar, Z., Khan, M. A., Soomro, A. S., Kumar, R., Bux, K., Haseeb, A., & Naz, A. (2022). Productivity Improvement of Assembly Line in Textile Stitching Unit by Lean Techniques of Line Balancing and Time and Motion Study. *International Journal of Science and Engineering Investigations (IJSEI)*, *11*(127), 51–60. http://www.ijsei.com/papers/ijsei-1112722-07.pdf

Iftikhar, Z., Kumar, R., Bux, K., Haseeb, A., Khan, M. A., Naz, A., Hassam, & Soomro, A. S. (2022). Lean Manufacturing Tools and Techniques for the Productivity Improvement in Assembly Lines Operations of Industries. *International Research Journal of Modernization in Engineering Technology and Science (IRJMETS)*, *4*(7), 4554–4562.

https://www.irjmets.com/uploadedfiles/paper//issue_7_july_2022/28986/final/fin_irjmets1663258443.pdf

Jaleel, N., Khan, M. A., Jamal, M., Safeeruddin, M., Shajee, M. M., & Mughal, U. (2021). Productivity Improvement by Lean Methodologies at Dyeing & Printing Plant. *Proceedings (Abstract) of the International Conference on Industrial & Mechanical Engineering and Operations Management Dhaka, Bangladesh, December 26-27, 2021.*, 905. https://ieomsociety.org/proceedings/2021dhaka/495.pdf

Kalwar, Muhammad Ahmed; Wassan, A. N., Khan, M. A., Wadho, Muzamil Hussain; Shaikh, S. A., & Marri, H. B. (2023). The Automation of Plan Paper Generating Workbook at Leather Footwear Company of Lahore by Using VBA in Microsoft Excel. *Journal of Applied Research in Technology & Engineering (JARTE)*, *4*(2). https://polipapers.upv.es/index.php/JARTE/article/view/18941

Kalwar, M. A., & Khan, M. A. (2020a). Optimization of Procurement & Purchase Order Process in Foot Wear Industry by Using VBA in Ms Excel. *International Journal of Business Education and Management Studies (IJBEMS)*, *6*(1), 213–220. https://ijbems.com/doc/IJBEMS-124.pdf

Kalwar, M. A., & Khan, M. A. (2020b). Optimization of Procurement & Purchase Order Process in Foot Wear Industry by Using VBA in Ms Excel. *International Journal of Business Education and Management Studies (IJBEMS)*, *5*(2), 80–100.

Kalwar, M. A., Khan, M. A., Phul, Z., Wadho, M. H., Shahzad, M. F., & Marri, H. B. (2022). The analysis of performance before and after ERP implementation: a case of a manufacturing company. *Journal of Applied Research in Technology & Engineering*, *3*(2), 115–121. https://doi.org/10.4995/jarte.2022.17789

Kalwar, M. A., Shahzad, M. F., Wadho, M. H., Khan, M. A., & Shaikh, S. A. (2022). Automation of order costing analysis by using Visual Basic for applications in Microsoft Excel. *Journal of Applied Research in Technology & Engineering (JARTE)*, *3*(1), 29–59. https://doi.org/10.4995/jarte.2022.16390

Karim, A. J. (2011). The Significance of Management Information Systems For Enhancing Strategic And Tactical Planning. *Journal of Information Systems and Technology Management*, *8*(2), 459–470. https://doi.org/10.4301/S1807-17752011000200011

Keramatpanah, A., Kambiz, S., Saeed, Y., & Mohsen, K. (2016). A Mathematical Model Designing to Achieve Cost Management in Value Chain with Combinational Approach of AHP & GP (Case Study: Home Appliance Industries). *SOCRATES: An International, Multi-Lingual, Multi-Disciplinary, Refereed (Peer-Reviewed), Indexed Scholarly Journal*, *4*(1), 30–51.

Khan, K., Khan, M. A., Thebo, J. A., Ahmed, T., & Rahoo, L. A. (2021). Examining The Human Resource Architecture Relationship With Employee Productivity Of Chemical Industries. *Journal of Contemporary Issues in Business and Government (CIBG)*, *27*(2), 5847–5856. https://www.cibgp.com/article_11267_91767391154f6eee74a8fa4a1c11a1c6.pdf

Khan, M. A. (2018). *Preliminary Study on Lean Manufacturing Practices at Yarn Manufacturing Industry - A Case Study* [Masters of Engineering (Thesis), Department of Industrial Engineering & Management, Mehran University of Engineering & Technology, Jamshoro, Sindh, Pakistan.]. https://doi.org/10.13140/RG.2.2.31557.37609

Khan, M. A., Kalwar, M. A., & Chaudhry, A. K. (2021). Optimization of material delivery time analysis by using Visual Basic for applications in Excel. *Journal of Applied Research in Technology & Engineering (JARTE)*, *2*(2), 89. https://doi.org/10.4995/jarte.2021.14786

Khan, M. A., Kalwar, M. A., Malik, A. J., Malik, T. S., & Chaudhry, A. K. (2021). Automation of Supplier Price Evaluation Report in MS Excel by Using Visual Basic for Applications: A Case of

Footwear Industry. *International Journal of Science and Engineering Investigations (IJSEI)*, *10*(113), 49–60. http://www.ijsei.com/papers/ijsei-1011321-08.pdf

Khan, M. A., Khatri, A., & Marri, H. B. (2020). Descriptive analysis of lean manufacturing practices in textile industry. *Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10 - 14, 2020*, 3870–3871. http://www.ieomsociety.org/detroit2020/papers/753.pdf

Khan, M. A., Marri, H. B., & Khatri, A. (2020). Exploring The Applications Of Lean Manufacturing Practices In Textile Industry. *Proceedings of the International Conference on Industrial Engineering and Operations Management, Dubai, UAE, March 10-12, 2020*, 2360–2361. http://www.ieomsociety.org/ieom2020/papers/545.pdf

Khan, M. A., Memon, M. S., & Soomro, A. S. (2020). Exploring the applications of lean manufacturing practices in automobile industry. *Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10 - 14, 2020*, *August*. http://www.ieomsociety.org/detroit2020/papers/727.pdf

Khan, M. A., Soomro, A. S., Shaikh, S. A., Memon, M. S., & Marri, S. (2020). Lean manufacturing in pakistan: A comprehensive review. *Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management Detroit, Michigan, USA, August 10 - 14, 2020*, *August*. http://www.ieomsociety.org/detroit2020/papers/728.pdf

Kuka, S., & Karamani, B. (2011). Using Excel and VBA for Excel to Learn Numerical Methods. *1st International Sympsosium on Computing in Informatics and Mathematics*, 365–376.

Kumar, S., Khan, M. A., Ahmed, S., Rehman, A., & Luhar, E. (2020). A Case Study for Performance Evaluation of Motorcycle Assembly Line through the Lean Manufacturing Practice of Overall Equipment Effectiveness (OEE). *Proceedings of the International Conference on Industrial Engineering and Operations Management Dubai, UAE, March 10-12, 2020*, 1622–1623. http://www.ieomsociety.org/ieom2020/papers/192.pdf

Lessa, J. D. R., Lessa, P. F. R., Almeida, P. A., Junior, M., & Guimarães, H. de V. (2016). Mathematical Model and Programming in VBA Excel for Package Calculation. *International Journal of Engineering Research and Applications*, *6*(5), 55–61.

Marin-Garcia, J. A., Garcia-Sabater, J. P., & Maheut, J. (2022). Case report papers guidelines: Recommendations for the reporting of case studies or action research in Business Management. *WPOM-Working Papers on Operations Management*, *13*(2), 108–137. https://doi.org/10.4995/wpom.16244

Minto, C. F. (2009). *PKPD Tools for Excel*.

Norton, T., & Tiwari, B. (2013). Aiding the understanding of novel freezing technology through numerical modelling with visual basic for applications (VBA). *Computer Applications in Engineering Education*, *21*(3), 530–538. https://doi.org/10.1002/cae.20498

Perry, K. M. (2012). *The Call Center Scheduling Problem using Spreadsheet Optimization and VBA*. Virginia Commonwealth University.

Porter, D., & Stretcher, R. (2012). Automating Markowitz Optimizations Using VBA. *Journal of Instructional Techniques in Finance*, *4*(1), 9–16.

Rajput, S., Khan, M. A., Samejo, S., Murtaza, G., & Ali, R. A. (2020). Productivity Improvement by the Implementation of lean manufacturing practice (takt time) in an automobile assembling plant. *Proceedings of the International Conference on Industrial Engineering and Operations Management Dubai, UAE, March 10-12, 2020*, 1618–1619. http://www.ieomsociety.org/ieom2020/papers/190.pdf

Raza, M., & Gulwani, S. (2017). Automated data extraction using predictive program synthesis. *31st AAAI Conference on Artificial Intelligence, AAAI 2017*, 882–890.

S. Ajinkya, W., S. Sachin, R., D. Manoj, S., M. Rajesh, R., & B. Mangesh, J. (2017). PREPARING EXCEL SHEET FOR ESTIMATION AND COSTING. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & MANAGEMENT*, *7*(1), 310–317.

Sato, K., & Yokoyama, R. (2001). Teaching Aid for Remote Sensing and Map Imagery Analysis Using Excel Spreadsheet and VBA. *22nd Asian Conference on Remote Sensing*.

Şuteu, M. D., Meşter, L. E., Bugnar, N. G., Andreescu, N., & Petrica, D. M. (2016). The impact of costing methods on profitability of enterprises operating in the embroidery industry. *Tekstil ve Konfeksiyon*, *26*(3), 239–243.

Wettlaufer, G. J. (2010). *Merlin.Net Automation of External Reports Verification Process* [California Polytechnic State University]. https://doi.org/10.1558/jsrnc.v4il.24

Yan, Q., & Wan, Y. (2017). Using the special font and VBA program to make bill of materials in the transmission line engineering. *Revista de La Facultad de Ingenieria*, *32*(2), 335–341.

Annexures

Annexure : 1

Notations

a1=Download transaction from Microsoft Dynamics AX into Excel

a2=Filter Warehouse column `H` with "EXP WH", "Lthr SMP" and "FWH"

a3=Delete Filtered rows

a4=Delete columns (H:O)

a5=Remove Autofilter mode

a6=Insert two columns (B and C)

a7=Put Headers on both columns (article and item respectively)

a8=Open the workbook of sale order detail

a9=Apply =vlookup in column B to pick up the article against Prd#

a10=Merge item number (E) + configuration (D) + size (F) + color (G) by =concatenate formulae

a11=Sum-up the Values of columns I and J

a12=Delete columns (D:G)

a13=Delete columns (E:F)

a14=Put headers on columns (A:E) (Prd#, Article, Items, Quantity, and financial cost amount)

a15=Convert the whole data into the pivot table

a16=Copy the data and paste next to the pivot table

a17=Delete pivot table

a18=Delete last row of the data containing the total

a19=Insert first two columns

a20=Put headers on both columns (Status, article)

a21=Put the status of articles as consumed

a22=Put the article number in column B

a23=Open the workbook of the order costing of the same order

a24=copy the data backup from the order costing report of the same order and paste it into the post order report

a25=Convert the whole data into the pivot table

a26=copy the data from a pivot table

a27=Paste the data next to the pivot table

a28=Delete the last row containing the total

a29=Calculate excess quantity of each item (Actual quantity - estimated quantity)

a30=Calculate standard rate, actual rate, price variance, and usage variance

a31=Put the grand totals for each article

a32=Put the interior color in the headers` row and make its font bold

a33=Put the interior color in row Totals and make its font bold

a34=Make the article bold, along with its pairs

a35=Copy and paste the format of the summary in the summary worksheet of the report

a36=Put sale price/pair

a37=Put estimated and actual total leather cost of each article

a38=Put estimated and actual total shoe material cost of each article

a39=Put estimated and actual total labor costs for each article

a40=Put estimated and actual total tooling cost for each article

a41=Put estimated and actual overheads for each article

a42=Put B-Pair Cost for each article

a43=Calculate cost/pair for all the individual subtotals for each article

a44=Calculate the total cost and total cost/pair for each article

a45=Put the picture of an article

Annexure : 2

Indices

h index refers to the number of shoe material items required for the production of the shoe *(h =1, 2, 3, …, p)*;

i index refers to the number of leather items required for the production of the shoe *(i =1, 2, 3, …, n)*;

j index refers to the number of colors of the shoe to be produced *(j =1, 2, 3, …, m)*;

k index refers to the number of articles (shoe type) in the order *(k =1, 2, 3, …, l)*;

o index referring to the cutting operations performed on the article *k* of color *j (o = 1, 2, 3, …, q)*;

s index referring to the sewing operations performed on the article *k* of color *j (s = 1, 2, 3, …, r)*;

g index refereeing to the lasting operations to be performed on the article *k* of color *j (g = 1, 2, 3, …, L)*;

t index referring to the hand stitching operations performed on the article *k* of color *j (t = 1, 2, 3, …, u)*;

v index referring to the molding operations performed on the article *k* of color *j (v = 1, 2, 3, …, w)*;

x index referring to the job work operations performed on the article *k* of color *j (x = 1, 2, 3, …, y)*;

a index referring to the number of cutting dies used in article *k* of color *j (a = 1, 2, 3, …, b)*;

c index referring to the number of lasts used in the article *k* of color *j (c = 1, 2, 3, …, d)*;

e index referring to the number of molds used in the article *k* of color *j (e = 1, 2, 3, …, f)*;

*p*index referring to the number of ordered sizes in the article *k* of color *j (P = 1, 2, 3, …, D)*.

Annexure : 3

Parameters

N = Number of pairs of article k of color j and size P;

CQ = consumed quantity of the item h, i to be used in the article j of color k;

C= cost of the item h, i to be used in article k of color j

ALM_c = actual cost of leather items h to be used in the article k of color j;

ASM_c = actual cost of shoe material items h other than leather to be used in the article k of color j;

ETM_c = total estimated material cost of the article k or color j;

ATM_c = total actual material cost of the article k or color j;

Cs = cost/second paid to the employee for producing an article k of color j;

EC_c = total estimated cost of cutting operations performed on article k of color j;

AC_c = total actual cost of cutting operations performed on article k of color j;

ES_c = total estimated cost of all stitching operations performed on article k of color j;

AS_c = total actual cost of all stitching operations performed on article k of color j;

AL_c = total actual cost of all lasting operations performed on article k of color j;

AM_c = total actual cost of all molding operations performed on article k of color j;

AHS_c = total actual cost of all hand stitching operations performed on article k of color j;

ETL_c = total estimated labor cost for article k of color j;

ATL_c = Total actual labor cost for article k of color j;

AT = actual time (sec) taken by an operation (cutting, stitching, lasting, job work, moulding) on the article k of color j;

O = factory overheads;

SAD = selling and administration cost for producing k^{th} article of j^{th} color;

ZT = zakat tax for the produced k^{th} article of j^{th} color;

LT_c = cost of leather testing of k^{th} article of j^{th} color;

TO = Total overheads for k^{th} article of j^{th} color;

D = cost of cutting dies ordered for producing k^{th} article of j^{th} color;

LS = cost of lasts produced for producing k^{th} article of j^{th} color;

M = cost of molds produced for producing k^{th} article of j^{th} color;

CDC = total cost of dies used for k^{th} article of j^{th} color;

LSC = Total cost of lasts produced for k^{th} article of j^{th} color;

MDC = Total cost of molds produced for k^{th} article of j^{th} color;

TTC= total tooling cost incurred on k^{th} article of j^{th} color;

OV = Order volume incurred on k^{th} article of j^{th} color;

BPP = B-pair percentage incurred on k^{th} article of j^{th} color;

BPC = B-pair cost incurred on k^{th} article of j^{th} color;

ETC = Total estimated cost incurred on k^{th} article of j^{th} color;

ATC = Total actual cost incurred on k^{th} article of j^{th} color;

ELCPP = estimated labor cost per pair incurred on k^{th} article of j^{th} color;

ALCPP = actual labor cost per pair incurred on k^{th} article of j^{th} color;

EMCPP = estimated material cost per pair incurred on k^{th} article of j^{th} color;

AMCPP = actual material cost per pair incurred on k^{th} article of j^{th} color;

OPP = overheads per pair incurred on k^{th} article of j^{th} color;

TCPP = tooling cost per pair incurred on k^{th} article of j^{th} color;

BPCPP = B-pair cost per pair incurred on k^{th} article of j^{th} color;

ETCPP = total estimated cost per pair incurred on the article k;

ATCPP = total actual cost per pair incurred on the article k;

DMCPP = Difference in estimated and actual material cost of k^{th} article of j^{th} color;

DLMQ = Difference between the estimated and actual leather quantity used in k^{th} article of j^{th} color;

DSMQ = Difference between the estimated and actual shoe material quantity used in in k^{th} article of j^{th} color;

CVLM = Cost variance for leather material used in k^{th} article of j^{th} color;

CVSM = Cost variance for shoe material used in k^{th} article of j^{th} color;

TMCV = Total material cost variance used in k^{th} article of j^{th} color;

UVLM = Usage variance for leather material used in k^{th} article of j^{th} color;

UVSM = Usage variance for shoe material used in k^{th} article of j^{th} color;

TMUV = Total material usage variance in k^{th} article of j^{th} color;

DLCPP = Difference of estimated and actual labor cost fork^{th} article of j^{th} color;

DTCPP = Difference of estimated and actual cost per pair fork^{th} article of j^{th} color;

Appendices

Appendix : 1

Transaction Backup‘ worksheet required in order and post-order costing (OPOC) template

	A	B	C	D	E	F	G	H	I	J	K
1	Number	Configuration	Item number	Size	Color	Quantity	Warehouse				
2	Prod_00173841	Cow	London Nbk	1.4-1.6 mm	Expresso	-2	Lthr Store				
3	Prod_00173841	Cow	Split Sued	1.2-1.4 mm	Expresso	-0.44	Lthr Store				
4	Prod_00173841	SyntSkLing	Syntc Socks Lining	Default	D/Brown	-0.04	Shoe Mat				
5	Prod_00173841	SyntSkLing	Syntc Socks Lining	Default	D/Brown	-0.04	Shoe Mat				
6	Prod_00173841	Buff	Lining Snuffed veg	0.7-0.9 mm	T.Moro	-0.39	Lthr Store				
7	Prod_00173841	ClothFurLn	Cloth Fur Lining	Default	Beige	-0.14	Shoe Mat				
8	Prod_00173841	ClothFurLn	Cloth Fur Lining	Default	Beige	-0.06	Shoe Mat				
9	Prod_00173841	RbrFomSock	Rubber Foam Socks	3 mm	Beige	-0.05	Shoe Mat				
10	Prod_00173841	ShetStobal	Stobal	Default	White	-0.05	Shoe Mat				
11	Prod_00173841	LablSokTra	Socks Label Trappeur	Default	BlkGryOrng	-2	Shoe Mat				
12	Prod_00173841	WovnLabel	Woven Label Made in Pakistan	Default	White/Blk	-2	Shoe Mat				
13	Prod_00173841	EvaSpunchF	Eva With Spunch Foam	2+10 mm	Beige&Grey	-0.03	Shoe Mat				
14	Prod_00173841	Foam	Foam	4mm	White	-0.01	Shoe Mat				
15	Prod_00173841	ShetToePuf	Sheet ToePuf 21	0.6 mm	White	-0.02	Shoe Mat				
16	Prod_00173841	ShetToePuf	Sheet ToePuf 25	0.8 mm	White	-0.02	Shoe Mat				
17	Prod_00173841	Cloth	Crimping Cloth Local	Default	White	-0.03	Shoe Mat				
18	Prod_00173841	ClothVmpWx	Vamp Cloth Waxed	Default	Off White	-0.03	Shoe Mat				
19	Prod_00173841	ClothPerln	Perlon Cloth	Default	Black	-0.02	Shoe Mat				
20	Prod_00173841	Thread Loc	Polyester Thread Local	20/3	Beige 265	-17	Shoe Mat				
21	Prod_00173841	Thread Loc	Polyester Thread Local	30/3	D/Brn 1002	-15	Shoe Mat				
22	Prod_00173841	Thread Loc	Polyester Thread Local	30/3	D/Brn 1002	-3	Shoe Mat				
23	Prod_00173841	Thread Loc	Polyester Thread Local	20/3	D/Brn 1002	-2	Shoe Mat				
24	Prod_00173841	Thread Loc	Polyester Thread Local	30/3	D/Brn 1002	-1	Shoe Mat				
25	Prod_00173841	Thread Loc	Polyester Thread Local	40/3	D/Brn 1002	-2	Shoe Mat				
26	Prod_00173841	Thread Loc	Polyester Thread Local	40/3	D/Brn 1002	-3	Shoe Mat				
27	Prod_00173841	EyeletRond	Eyelets	GunMetal B	Brown	-16	Shoe Mat				
28	Prod_00173841	EyeletHook	Hooks	132	Antique	-8	Shoe Mat				
29	Prod_00173841	Tape	Seaming Tape	14 mm	White	-0.15	Shoe Mat				
30	Prod_00173841	Chemical	Pasting Solution Ltr	Default	Yellow	-0.03	Shoe Mat				
31	Prod_00173841	Chemical	Latex	Default	White	-0.02	Shoe Mat				
32	Prod_00173841	TPR	TPR Grain	60	D/Honey	-0.33	Shoe Mat				
33	Prod_00173841	TPR	TPR Grain	60	Coffee	-0.2	Shoe Mat				
34	Prod_00173841	Chemical	TPR Finishes	Default	Natural	-0.01	Shoe Mat				
35	Prod_00173841	ShetWintex	Insole Wintex Sheet	1.5 mm	Default	-0.05	Shoe Mat				
36	Prod_00173841	Chemical	Pasting Solution Ltr	Default	Yellow	-0.01	Shoe Mat				
37	Prod_00173841	Chemical	Latex	Default	White	-0.01	Shoe Mat				
38	Prod_00173841	Chemical	Keck Priemer 705	Default	Default	-0.03	Shoe Mat				
39	Prod_00173841	Thread Loc	Polyester Thread Local	10/3	M/Brown262	-2	Shoe Mat				

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 2

‘Articles‘ worksheet required in order and post-order costing (OPOC) template

	A	B	C	D	E	F	G	H	I	J	K	L
1	Article	Pairs	Num. Rows	Proposed Value	Consumed Value	Actual Pairs	Sale Price					
2	2083 DBY	3	38	3446.242	3446.242	4	2000					
3	2979 DBY	182	42	236301.438	236301.438	186	2200					
4	3686 (VIV	4489	72	5154952.43	5154952.43	4496	2000					
5	4543 CFS	1496	58	2164022.027	2164022.027	1500	2000					
6	4600 DBY	3	38	2187756.547	2187756.547	4	2000					
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 3

'Raw Data' worksheet required in order and post-order costing (OPOC) template

Article # 2083 DBY
Total Pairs = 3

Items	Proposed Qty	Consumed Qty	Excess/(Short) Quantity	Standard Rate	Actual Rate	Proposed Value	Consumed Value	Price Variance	Usage Variance
Alarm ChipMicro PakDefaultGreen	3	3	0	7	7	21	21	0	0
BuffLining Snuffed veg0.7-0.9 mmBrown	4.19	4.19	0	85	85	356.15	356.15	0	0
BuffPet1.4-1.6 mmNavy	1.64	1.64	0	155	155	254.2	254.2	0	0
ChemicalCrazy Horse(SQ6040)DefaultDefault	0.02	0.02	0	800	800	16	16	0	0
ChemicalEthylestateDefaultDefault	0.01	0.01	0	300	300	3	3	0	0
ChemicalKeck Priemer 705DefaultDefault	0.12	0.12	0	485	485	58.2	58.2	0	0
ChemicalLatexDefaultWhite	0.08	0.08	0	410	410	32.8	32.8	0	0
ChemicalMethylEthylKetone(MEK)DefaultDefault	0.02	0.02	0	400	400	8	8	0	0
ChemicalPasting Solution LtrDefaultYellow	0.07	0.07	0	310	310	21.7	21.7	0	0
ChemicalTPR FinishesDefaultNatural	0.04	0.04	0	700	700	28	28	0	0
ClothCrimping Cloth LocalDefaultWhite	0.27	0.27	0	110	110	29.7	29.7	0	0
CowPeach Soft1.4-1.6 mmNamibia	0.16	0.16	0	215	215	34.4	34.4	0	0
CowPeach Soft1.6-1.8 mmNamibia	6.45	6.45	0	220	220	1419	1419	0	0
ElasticImpElastic Imported80 mmD/Brown	0.33	0.33	0	204	204	67.32	67.32	0	0
EyeletRondEyeletsGunMetal BBrown	24	24	0	1.46	1.46	35.04	35.04	0	0
FoamFoam10mmGrey	0.04	0.04	0	40	40	1.6	1.6	0	0
FoamFoam4mmWhite	0	0	0			0	0	0	0
GoatHeel Grip0.5-0.7 mmBrown	1.05	1.05	0	90	90	94.5	94.5	0	0
PackngGen.Nylon String5"White	3	3	0	0.15	0.15	0.45	0.45	0	0
PackngTapePacking Tape Regular7 cmL/Brown	0.07	0.07	0	100	100	7	7	0	0
PictogramLthr+Lthr+Other2.5x2 cmGolden	3	3	0	2.5	2.5	7.5	7.5	0	0
RbrFomSockRubber Foam Socks3 mmBeige	0.15	0.15	0	176	176	26.4	26.4	0	0
ShetWintexInsole Wintex Sheet1.5 mmDefault	0.13	0.13	0	300	300	39	39	0	0
Shoe BoxDubarry340x210x12Blue	3	3	0	68	68	204	204	0	0
Sht BackCTSheet Back Counter221.2 mmDefault	0.06	0.06	0	650	650	39	39	0	0
SteelShankSteel Shank4"Default	6	6	0	3.5	3.5	21	21	0	0
StickerShoe Box Stckr DubarryDefaultWhite	3	3	0	3.5	3.5	10.5	10.5	0	0
Tag CardTag Card Dubarry65x45 mmGreen/Blue	3	3	0	2	2	6	6	0	0
TapeNnStrNone Stretchable Tape10 mmBlack	0.33	0.33	0	4.4	4.4	1.452	1.452	0	0
Thread H/SHand Stitch Waxy Thread Local1 mmOff White	9	9	0	1.03	1.03	9.27	9.27	0	0
Thread LocPolyester Thread Local10/3Beige 265	3	3	0	0.5	0.5	1.5	1.5	0	0
Thread LocPolyester Thread Local20/3Beige 265	39	39	0	0.18	0.18	7.02	7.02	0	0
Thread LocPolyester Thread Local30/3M/Brown262	24	24	0	0.09	0.09	2.16	2.16	0	0
Thread LocPolyester Thread Local40/3M/Brown262	15	15	0	0.08	0.08	1.2	1.2	0	0
Thread LocPolyester Thread Local40/3White 2000	12	12	0	0.08	0.08	0.96	0.96	0	0
TPRTPR Grain60L/Honey	0.6	0.6	0	326	326	195.6	195.6	0	0
TPRTPR Grain60White	0.96	0.96	0	372	372	357.12	357.12	0	0
WrapngPaprWrapping Paper DubarryDefaultWhite	3	3	0	9.5	9.5	28.5	28.5	0	0
Grand Total	**169.79**	**169.79**				**3446.242**	**3446.242**	**0**	**0**

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 4

'Sale Order Detail' worksheet required in order and post-order costing (OPOC) template

Prods Number	Art	Color
Prod_00170000	ND-AZ-0023	Brown
Prod_00170001	ND-AZ-0023	Brown
Prod_00170002	ND-AZ-0023	Brown
Prod_00170003	ND-AZ-0023	Brown
Prod_00170004	ND-AZ-0023	Brown
Prod_00170005	ND-AZ-0023	Brown
Prod_00170006	ND-AZ-0023	Brown
Prod_00170007	ND-AZ-0023	Brown
Prod_00170008	ND-AZ-0023	Brown
Prod_00170009	ND-AZ-0023	Brown
Prod_00170010	ND-AZ-0023	Brown
Prod_00170011	ND-AZ-0023	Brown
Prod_00170012	ND-AZ-0023	Brown
Prod_00170013	ND-AZ-0023	Brown
Prod_00170014	ND-AZ-0023	Brown
Prod_00170015	ND-AZ-0023	Brown
Prod_00170016	ND-AZ-0023	Brown
Prod_00170017	ND-AZ-0023	Brown
Prod_00170018	ND-AZ-0023	Coffee
Prod_00170019	ND-AZ-0023	Coffee
Prod_00170020	ND-AZ-0023	Coffee
Prod_00170021	ND-AZ-0023	Coffee
Prod_00170022	ND-AZ-0023	Coffee
Prod_00170023	ND-AZ-0023	Coffee
Prod_00170024	ND-AZ-0023	Coffee
Prod_00170025	ND-AZ-0023	Coffee
Prod_00170026	ND-AZ-0023	Coffee
Prod_00170027	ND-AZ-0023	Coffee
Prod_00170028	ND-AZ-0023	Coffee
Prod_00170029	ND-AZ-0023	Coffee
Prod_00170030	ND-AZ-0038	D.Brown
Prod_00170031	ND-AZ-0038	D.Brown
Prod_00170032	ND-AZ-0038	D.Brown
Prod_00170033	ND-AZ-0038	D.Brown
Prod_00170034	ND-AZ-0038	D.Brown
Prod_00170035	ND-AZ-0038	D.Brown
Prod_00170036	ND-AZ-0038	D.Brown
Prod_00170037	ND-AZ-0038	D.Brown

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 5

'Mat Price List' worksheet required in order and post-order costing (OPOC) template

Item Number	Price	Remarks
Buff London Nbk1.4-1.6 mmRed	145.00	
Buff London Nbk1.6-1.8 mmOcean	150.00	
BURNISHED PU (HEEL SEAT)	200.00	
Sole Tori-1 White Imp	350.00	
ELASTIC	230.00	
ElasticImp Elastic Imported 80 mm Black	152.88	
FY-088 Eva Sole Beige/Offwhite 42	180.00	
Kalash bottom	190.00	
Kalash Wedge	158.00	
M-1 Millitary	210.00	
Synthetic beige	230.00	
Waxed Offwhite	85.00	
PU Anatomic-211 (Zurich) Brown	161.00	29-05-2019 ($151) VIV
Synthetic Black,Brown and D.brown	210.00	29-05-2019 ($151) VIV
011- EVA Premolded Insock Plain (TS)	45.00	
011- EVA Premolded Insock with Microfiber (TS)	50.00	
16462 Brass Antique Metal	13.00	
16462 golden Metal	13.00	
16462 Gun Metal	12.00	
16462 silver Metal	12.00	
285x155x100 mm (Urban Sole)	27.66	
330x200x125mm (Urban Sole)	29.60	
330x200x130mm (Urban sole)	30.70	
330x220x125mm (Urban sole)	33.50	
5# metal zipper, black nickle,8",normal puller	43.00	
5# metal zipper, nickle,8",normal puller	43.00	
5# metal zipper, shiny gold,8",normal puller	65.00	
5# metal zipper,anti-silver,8",normal puller	45.00	
515 EVA	230.00	
56.5*48.1*35	95.00	
60969 Brass Antique Metal	13.00	
60969 golden Metal	13.00	
60969 Gun Metal	12.00	
60969 silver Metal	12.00	
62.5*50.5*35.5	104.00	
62.5*52.5*35.5	110.00	

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 6

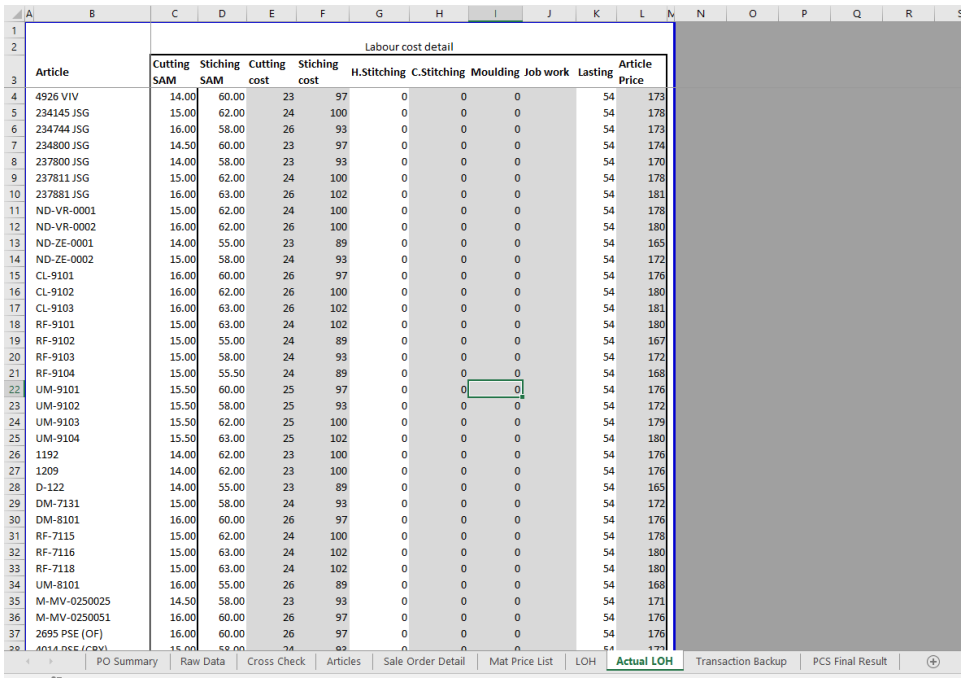
'LOH' worksheet required in order and post-order costing (OPOC) template

	Labour cost detail								Over heads detail					Tooling cost detail				
Article	Cutting cost	Stiching cost	H.Stitching	C.Stitching	Moulding	Job work	Lasting	Article Price	Over Heads	Selling & admin	Z.Tax	L.Test cost	Total LOH	Cutting dies	Lasts	Moulds	Misc.	Total tooling cost
4926 VIV	23	97	0	0	0		54	173	250	-	-	-	250					0
234145 JSG	24	100	0	0	0		54	178	250	-	-	-	250					0
234744 JSG	26	93	0	0	0		54	173	250	-	-	-	250					0
234800 JSG	23	97	0	0	0		54	174	250	-	-	-	250					0
237800 JSG	23	93	0	0	0		54	170	250	-	-	-	250					0
237811 JSG	24	100	0	0	0		54	178	250	-	-	-	250					0
237881 JSG	26	102	0	0	0		54	181	250	-	-	-	250					0
ND-VR-0001	24	100	0	0	0		54	178	250	-	-	-	250					0
ND-VR-0002	26	100	0	0	0		54	180	250	-	-	-	250					0
ND-ZE-0001	23	89	0	0	0		54	165	250	-	-	-	250					0
ND-ZE-0002	24	93	0	0	0		54	172	250	-	-	-	250					0
CL-9101	26	97	0	0	0		54	176	250	-	-	-	250					0
CL-9102	26	100	0	0	0		54	180	250	-	-	-	250					0
CL-9103	26	102	0	0	0		54	181	250	-	-	-	250					0
RF-9101	24	102	0	0	0		54	180	250	-	-	-	250					0
RF-9102	24	89	0	0	0		54	167	250	-	-	-	250					0
RF-9103	24	93	0	0	0		54	172	250	-	-	-	250					0
RF-9104	24	89	0	0	0		54	168	250	-	-	-	250					0
UM-9101	25	97	0	0	0		54	176	250	-	-	-	250					0
UM-9102	25	93	0	0	0		54	172	250	-	-	-	250					0
UM-9103	25	100	0	0	0		54	179	250	-	-	-	250					0
UM-9104	25	102	0	0	0		54	180	250	-	-	-	250					0
1192	23	100	0	0	0		54	176	250	-	-	-	250					0
1209	23	100	0	0	0		54	176	250	-	-	-	250					0
D-122	23	89	0	0	0		54	165	250	-	-	-	250					0
DM-7131	24	93	0	0	0		54	172	250	-	-	-	250					0
DM-8101	26	97	0	0	0		54	176	250	-	-	-	250					0
RF-7115	24	100	0	0	0		54	178	250	-	-	-	250					0
RF-7116	24	102	0	0	0		54	180	250	-	-	-	250					0
RF-7118	24	102	0	0	0		54	180	250	-	-	-	250					0
UM-8101	26	89	0	0	0		54	168	250	-	-	-	250					0
M-MV-0250025	23	93	0	0	0		54	171	250	-	-	-	250					0
M-MV-0250051	26	97	0	0	0		54	176	250	-	-	-	250					0
2695 PSE (OF)	26	97	0	0	0		54	176	250	-	-	-	250					0

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 7

'Actual LOH' worksheet required in order and post-order costing (OPOC) template

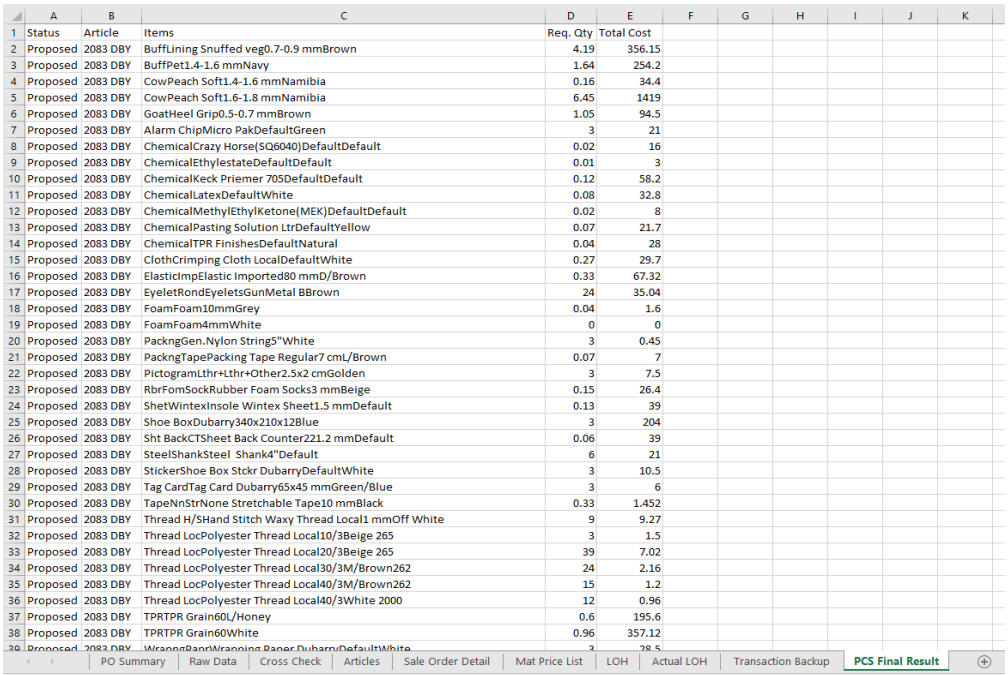


	Article	Labour cost detail									
		Cutting SAM	Stiching SAM	Cutting cost	Stiching cost	H.Stitching	C.Stitching	Moulding	Job work	Lasting	Article Price
4	4926 VIV	14.00	60.00	23	97	0	0	0		54	173
5	234145 JSG	15.00	62.00	24	100	0	0	0		54	178
6	234744 JSG	16.00	58.00	26	93	0	0	0		54	173
7	234800 JSG	14.50	60.00	23	97	0	0	0		54	174
8	237800 JSG	14.00	58.00	23	93	0	0	0		54	170
9	237811 JSG	15.00	62.00	24	100	0	0	0		54	178
10	237881 JSG	16.00	63.00	26	102	0	0	0		54	181
11	ND-VR-0001	15.00	62.00	24	100	0	0	0		54	178
12	ND-VR-0002	16.00	62.00	26	100	0	0	0		54	180
13	ND-ZE-0001	14.00	55.00	23	89	0	0	0		54	165
14	ND-ZE-0002	15.00	58.00	24	93	0	0	0		54	172
15	CL-9101	16.00	60.00	26	97	0	0	0		54	176
16	CL-9102	16.00	62.00	26	100	0	0	0		54	180
17	CL-9103	16.00	63.00	26	102	0	0	0		54	181
18	RF-9101	15.00	63.00	24	102	0	0	0		54	180
19	RF-9102	15.00	55.00	24	89	0	0	0		54	167
20	RF-9103	15.00	58.00	24	93	0	0	0		54	172
21	RF-9104	15.00	55.50	24	89	0	0	0		54	168
22	UM-9101	15.50	60.00	25	97	0	0	0		54	176
23	UM-9102	15.50	58.00	25	93	0	0	0		54	172
24	UM-9103	15.50	62.00	25	100	0	0	0		54	179
25	UM-9104	15.50	63.00	25	102	0	0	0		54	180
26	1192	14.00	62.00	23	100	0	0	0		54	176
27	1209	14.00	62.00	23	100	0	0	0		54	176
28	D-122	14.00	55.00	23	89	0	0	0		54	165
29	DM-7131	15.00	58.00	24	93	0	0	0		54	172
30	DM-8101	16.00	60.00	26	97	0	0	0		54	176
31	RF-7115	15.00	62.00	24	100	0	0	0		54	178
32	RF-7116	15.00	63.00	24	102	0	0	0		54	180
33	RF-7118	15.00	63.00	24	102	0	0	0		54	180
34	UM-8101	16.00	55.00	26	89	0	0	0		54	168
35	M-MV-0250025	14.50	58.00	23	93	0	0	0		54	171
36	M-MV-0250051	16.00	60.00	26	97	0	0	0		54	176
37	2695 PSE (OF)	16.00	60.00	26	97	0	0	0		54	176

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result

Appendix : 8

'PCS Final Result' worksheet required in order and post-order costing (OPOC) template



	Status	Article	Items	Req. Qty	Total Cost
2	Proposed	2083 DBY	BuffLining Snuffed veg0.7-0.9 mmBrown	4.19	356.15
3	Proposed	2083 DBY	BuffPet1.4-1.6 mmNavy	1.64	254.2
4	Proposed	2083 DBY	CowPeach Soft1.4-1.6 mmNamibia	0.16	34.4
5	Proposed	2083 DBY	CowPeach Soft1.6-1.8 mmNamibia	6.45	1419
6	Proposed	2083 DBY	GoatHeel Grip0.5-0.7 mmBrown	1.05	94.5
7	Proposed	2083 DBY	Alarm ChipMicro PakDefaultGreen	3	21
8	Proposed	2083 DBY	ChemicalCrazy Horse(SQ6040)DefaultDefault	0.02	16
9	Proposed	2083 DBY	ChemicalEthylestateDefaultDefault	0.01	3
10	Proposed	2083 DBY	ChemicalKeck Priemer 705DefaultDefault	0.12	58.2
11	Proposed	2083 DBY	ChemicalLatexDefaultWhite	0.08	32.8
12	Proposed	2083 DBY	ChemicalMethylEthylKetone(MEK)DefaultDefault	0.02	8
13	Proposed	2083 DBY	ChemicalPasting Solution LtrDefaultYellow	0.07	21.7
14	Proposed	2083 DBY	ChemicalTPR FinishesDefaultNatural	0.04	28
15	Proposed	2083 DBY	ClothCrimping Cloth LocalDefaultWhite	0.27	29.7
16	Proposed	2083 DBY	ElasticImpElastic Imported80 mmD/Brown	0.33	67.32
17	Proposed	2083 DBY	EyeletRondEyeletsGunMetal BBrown	24	35.04
18	Proposed	2083 DBY	FoamFoam10mmGrey	0.04	1.6
19	Proposed	2083 DBY	FoamFoam4mmWhite	0	0
20	Proposed	2083 DBY	PackngGen.Nylon String5"White	3	0.45
21	Proposed	2083 DBY	PackngTapePacking Tape Regular7 cmL/Brown	0.07	7
22	Proposed	2083 DBY	PictogramLthr+Lthr+Other2.5x2 cmGolden	3	7.5
23	Proposed	2083 DBY	RbrFomSockRubber Foam Socks3 mmBeige	0.15	26.4
24	Proposed	2083 DBY	ShetWintexInsole Wintex Sheet1.5 mmDefault	0.13	39
25	Proposed	2083 DBY	Shoe BoxDubarry340x210x12Blue	3	204
26	Proposed	2083 DBY	Sht BackCTSheet Back Counter221.2 mmDefault	0.06	39
27	Proposed	2083 DBY	SteelShankSteel Shank4"Default	6	21
28	Proposed	2083 DBY	StickerShoe Box Stckr DubarryDefaultWhite	3	10.5
29	Proposed	2083 DBY	Tag CardTag Card Dubarry65x45 mmGreen/Blue	3	6
30	Proposed	2083 DBY	TapeNnStrNone Stretchable Tape10 mmBlack	0.33	1.452
31	Proposed	2083 DBY	Thread H/SHand Stitch Waxy Thread Local1 mmOff White	9	9.27
32	Proposed	2083 DBY	Thread LocPolyester Thread Local10/3Beige 265	3	1.5
33	Proposed	2083 DBY	Thread LocPolyester Thread Local20/3Beige 265	39	7.02
34	Proposed	2083 DBY	Thread LocPolyester Thread Local30/3M/Brown262	24	2.16
35	Proposed	2083 DBY	Thread LocPolyester Thread Local40/3M/Brown262	15	1.2
36	Proposed	2083 DBY	Thread LocPolyester Thread Local40/3White 2000	12	0.96
37	Proposed	2083 DBY	TPRTPR Grain60L/Honey	0.6	195.6
38	Proposed	2083 DBY	TPRTPR Grain60White	0.96	357.12

PO Summary | Raw Data | Cross Check | Articles | Sale Order Detail | Mat Price List | LOH | Actual LOH | Transaction Backup | PCS Final Result