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INNOVATING PROCUREMENT OPERATIONS: AN INTEGRATED PURCHASE ORDER MANAGEMENT IN THE PURCHASING DEPARTMENT

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ABSTRACT

This project aims to develop a better Purchase Order Management (POM) system for the Purchasing Department. The current system uses only Microsoft Excel and involves many separate files, which makes the process slow and complicated. To solve this, a new system was created using Microsoft Excel combined with Visual Basic for Applications (VBA). This new system combines all processes into one file and helps reduce the time needed to complete purchase orders. The report explains how the new system was designed and built by studying the best methods and tools available. It focuses on making the process easier and faster by improving tasks such as filling out forms, tracking deliveries, and recording information in the logbook. The study includes 15 purchase samples orders and were compared using both the old and new systems. The results showed that the old system took an average of 192.53 seconds per order, while the new system only took 59.65 seconds. This means the new system saved about 132.88 seconds, or 69% less time on average. The time savings were consistent across all orders. In conclusion, this project shows that using Excel and VBA together can greatly improve the speed and efficiency of managing purchase orders, making the work process easier and more effective for the department.

1. Introduction

Procurement is the method of discovering and accepting agreements to purchasing goods, services or other works from a third party. When comparing factors like quality, quantity, time and location, procurement as an organisational process aims to guarantee that the buyer obtains goods, services, or works at the best price possible. Almost all purchase decisions consider elements including shipping and handling, marginal benefit, and changes in product costs (Rowlinson and McDermott, 2023). The procurement department undertakes a variety of responsibilities to achieve their main objective, which is to purchase technical tools, components, goods, and services for assembling, manufacturing, or supplying, as well as plan for cost-cutting and supplies. According to Robin & Mark (2023), the building and nurturing of supplier relationships is considered good management. Despite having certain similarities, the phrases procurement and purchase are sometimes used interchangeably. Procurement is

more involved in the process of choosing vendors, negotiating contracts, monitoring the quality of the parts and services, negotiating the payment terms, and purchasing the goods. Purchase Order Management (POM) is a system where it can be defined as a process of issuing Purchase Order (PO) until receiving the order to use for the production. POM is a wide range of capabilities are used for

keeping buying information for any business or organization. This system also can enhance accuracy, timeliness, and efficiency of operation (Satapom 2023). An organized system will decrease the amount of work (Muhammad et al., 2023). Automating the PO management process can save time and reduce errors associated with manual data entry. This can free up staff time to focus on more value-added activities, such as vendor management, and negotiating better pricing and terms (Bing et al., 2022).
In this company, the POM system is using many different files for tracking the order such as PO, Delivery Monitoring and Logbook. PO files are used to generate PO. Delivery monitoring is a file that track every delivered item to the warehouse while logbook is a file that contains every order that already made and tracking every process of the order. For many different files, it hard to manage the order and sometimes can be difficult to collect data for the order. As an idea, merge all the files that require for POM are easier to monitor, collect data and easier process of order update and tracking. Automating the PO management process can reduce the risk of human errors associated with manual data entry, such as typos or incorrect calculations (Tom 2014). Other than using many different files, the layout also is difficult to find the item that still pending from the supplier. The objective of this project are:

1. To study the purchase order management system.
2. To develop a semi-automatic Purchase Order Management System using Microsoft Excel.
3. To measure the effectiveness of the new Purchase Order Management System in the Purchasing Department.

2. Materials and Methods

In this project, it involves several steps that need to be done to develop the entire system. In this chapter, explanation of the research methodology used for this project, describe how to construct the proposed application, including the procedures and processes used in its data analysis and data collection, as well as strategies for analysing the data collected. This chapter will provide a detailed explanation of the methodology that has been applied to complete and successfully complete this project.

2.1 Process Flow Chart

The flow chart is very important because it shows the step-by-step process of how the Purchase Order (PO) Management System works, from start to finish. In this chapter, the flow is explained to show how the system layout was improved as shown in Figure 1. The first step

was to have discussions with the supervisor to share ideas and find problems in the current purchasing process. After finding the problems, the project goals and scope were set. The final part of this step was to research and understand how the current PO system works. The next step was to design a new layout for the system. Several designs were made and tested to choose the best one. Supplier data and item lists were collected to create a database that could automatically fill in details in the PO form. All the sheets in the system were connected using VBA, formulas, and macros. The system was tested to find any errors. If errors were found, they were fixed and tested again until the system worked perfectly. This process also allowed the system to be improved over time. Finally, after the system was complete, all data was collected and analyzed. A final check was done to make sure everything was correct. Once all objectives were achieved, the project details were written in a proposal and submitted.

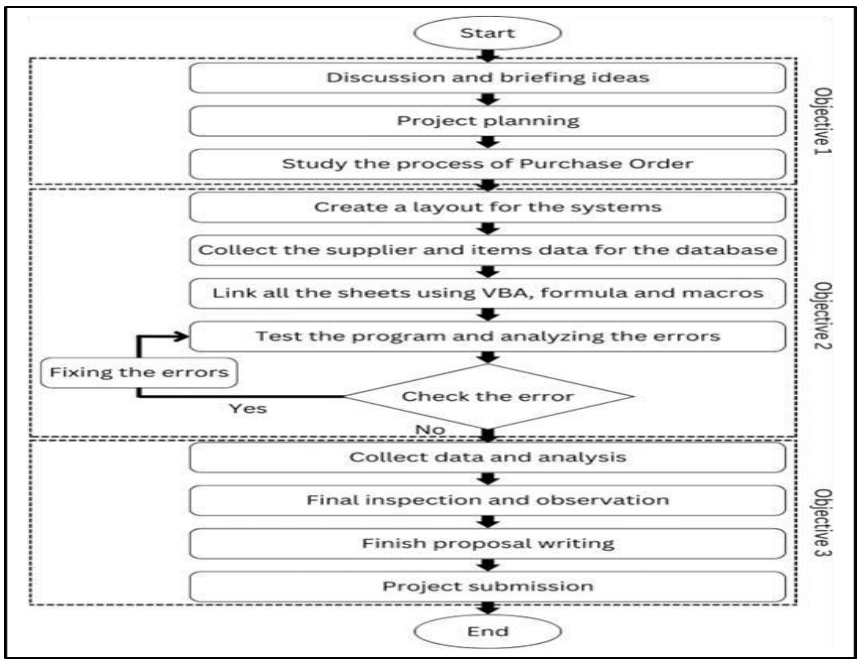


Figure 1. Process flow chart

2.2 Design Concept Layout

A design concept layout is the underlying idea or principle that guides the development of this project. This design concept shows the shapes of the final design layout and ensures it aligns with the project's goals.

2.3 Purchase Order (PO)

PO form contains important details for any order issues such as the PO number, supplier details, orders type, delivery details, requestor, PO date, ETA, PR number, JN number, payment term, delivery term, SST number, number of items, part number, description, order quantity, UOM,

unit price, the amount, total amount, currency, and authorized signature as shown in Figure 2. This PO layout cannot change due to the official company PO form.

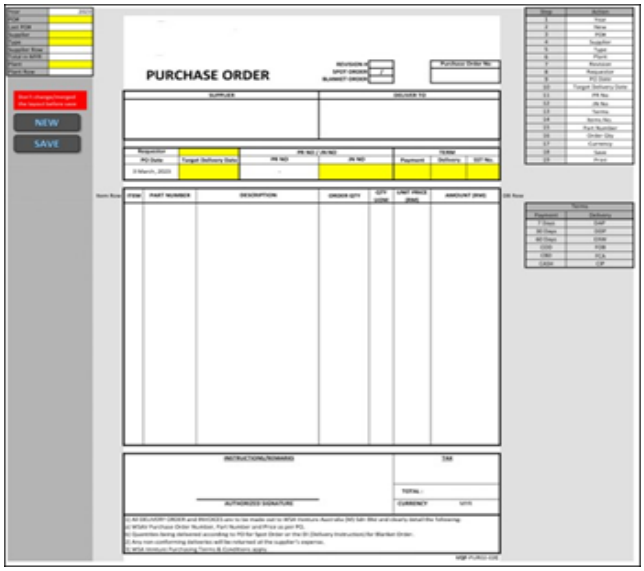


Figure 2. Purchase Order form and instructions

2.4 Logbook

This logbook includes the PO number, type, PO date, PR number, JN number, supplier, currency, PO amount, PO amount (MYR), date issued & emailed to supplier, date received & acknowledge by supplier, mode of acceptance/acknowledge, date closed, status, ETA, payment notification to finance department, invoice date, proforma invoice/invoice number, payment due date, amount invoice, and purchasing remarks. These sheets also cannot be changed due to their functionality are complete and they are also being used by other departments.

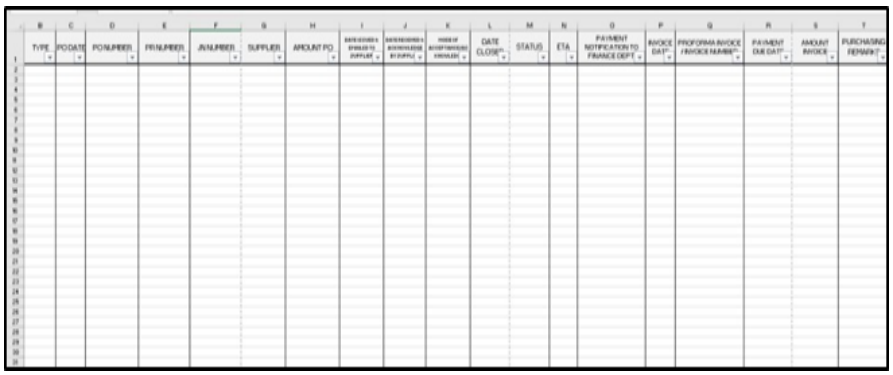


Figure 3. Logbook header design

2.5 Delivery Monitoring

For deliver monitoring, it shows the supplier, PO number, Part Number (PN), description, quantity order, Unit of Material (UOM), balance, total received, date closed, status of the PO, receiving details including DO number, ETA, receive date, and quantity receive. The recent layout has some disadvantages such as it does not have the DO number details, ETA details, item balanced, and status of the items in Figure 3. New designs as show in Figure 4 are easier to use when looking for item balance and the item details. If problems occur with the order such as the quantity received are different, the status of the order will change its colour to notify the user. The header format will be copied from the Table Layout sheet.

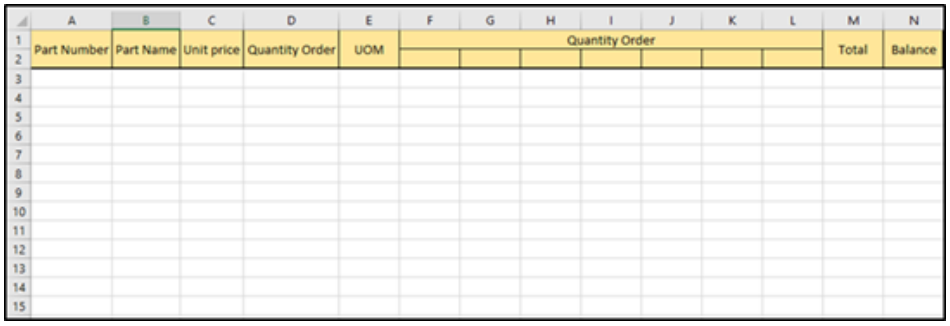


Figure 4. Existing delivery monitoring header design template

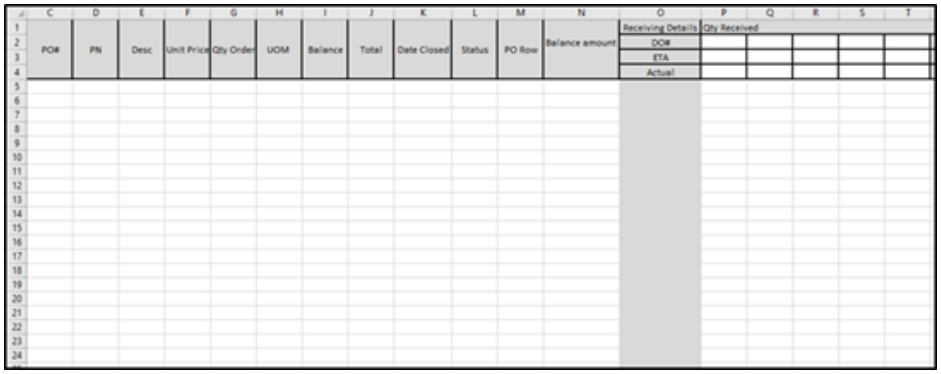


Figure 5. New delivery monitoring header design template

2.6 Supplier list and plant address

Supplier lists are used to store supplier details such as supplier name, their address, contact number, and email address as in Figure 5. This sheet will combine with the data validation function which can be used to choose the right supplier and the details of the supplier will automatically appear on PO. POM in the company does not have the supplier details linked to the PO sheets.

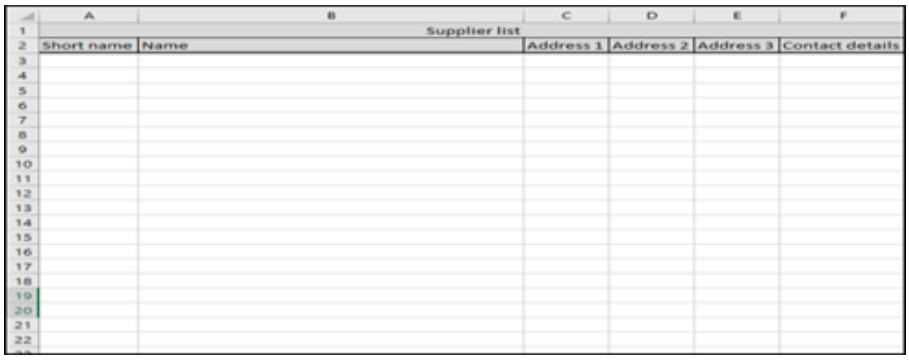


Figure 6. Supplier list header design

2.7 Item List

The item list shows the item used to order that contains part number, description, the latest price, and the supplier as show in Figure 6. This list also will link with the PO sheets to choose the right item and the details of the supplier will automatically appear on PO. If the PN are filled in the PO is not available, it will pop-up showing error data input. POM in the company does not have the details linked to the PO sheets.

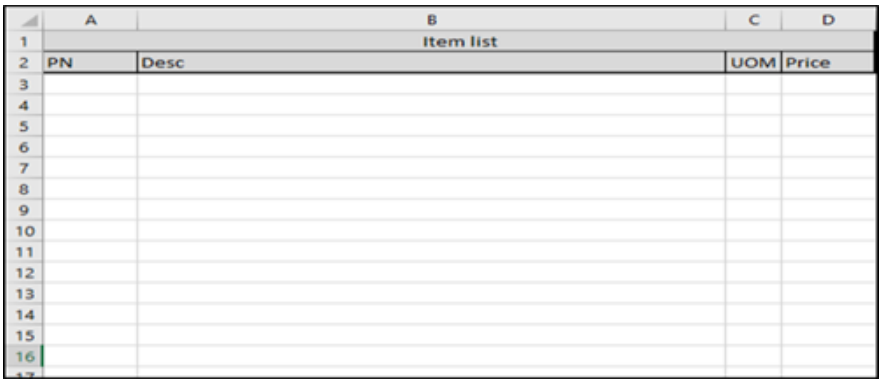
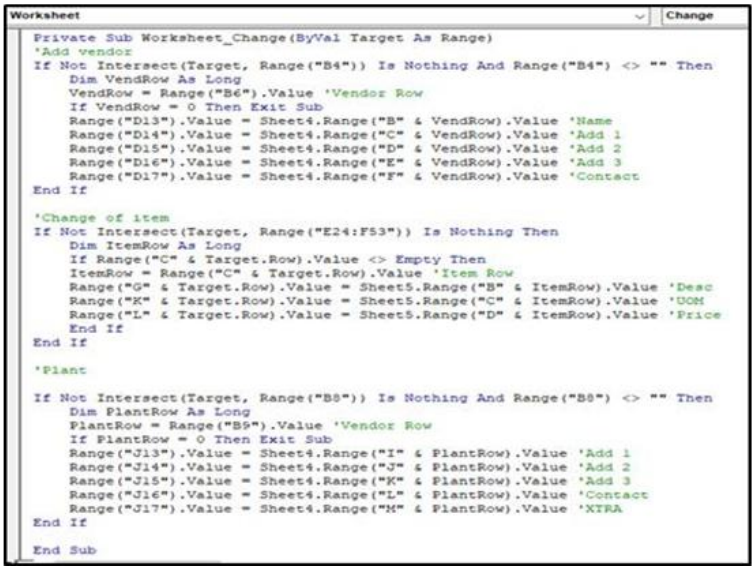


Figure 7. Item list header design

2.8 Visual Basic for Application (VBA)

VBA or Visual Basic for Application are the essential items that are used to improve the process which is used for most Microsoft Office applications. This feature use to customize the apps by using programming language. The Office suite of applications has a full set of features. There are many ways to author, format, and manipulate documents, email, databases, forms, spreadsheets, and presentations. The use of VBA can decrease the steps on key-in the data to the systems. Other than that, you can add macro, which is adding new functionality to the Office application for your need.

Microsoft Excel Object codes in Figure 8 are used to automatically appear the data from the database which requires an input that is assigned to it. As an example, the supplier data such as full supplier name, address and their contact will appear on the assigned cells.



```
Worksheet                                                    Change
Private Sub Worksheet_Change(ByVal Target As Range)
'Add vendor
If Not Intersect(Target, Range("B4")) Is Nothing And Range("B4") <> "" Then
    Dim VendRow As Long
    VendRow = Range("B6").Value 'Vendor Row
    If VendRow = 0 Then Exit Sub
    Range("D13").Value = Sheet4.Range("B" & VendRow).Value 'Name
    Range("D14").Value = Sheet4.Range("C" & VendRow).Value 'Add 1
    Range("D15").Value = Sheet4.Range("D" & VendRow).Value 'Add 2
    Range("D16").Value = Sheet4.Range("E" & VendRow).Value 'Add 3
    Range("D17").Value = Sheet4.Range("F" & VendRow).Value 'Contact
End If

'Change of item
If Not Intersect(Target, Range("E24:F53")) Is Nothing Then
    Dim ItemRow As Long
    If Range("C" & Target.Row).Value <> Empty Then
    ItemRow = Range("C" & Target.Row).Value 'Item Row
    Range("G" & Target.Row).Value = Sheet5.Range("B" & ItemRow).Value 'Desc
    Range("K" & Target.Row).Value = Sheet5.Range("C" & ItemRow).Value 'UOM
    Range("L" & Target.Row).Value = Sheet5.Range("D" & ItemRow).Value 'Price
    End If
End If

'Plant

If Not Intersect(Target, Range("B8")) Is Nothing And Range("B8") <> "" Then
    Dim PlantRow As Long
    PlantRow = Range("B9").Value 'Vendor Row
    If PlantRow = 0 Then Exit Sub
    Range("J13").Value = Sheet4.Range("I" & PlantRow).Value 'Add 1
    Range("J14").Value = Sheet4.Range("J" & PlantRow).Value 'Add 2
    Range("J15").Value = Sheet4.Range("K" & PlantRow).Value 'Add 3
    Range("J16").Value = Sheet4.Range("L" & PlantRow).Value 'Contact
    Range("J17").Value = Sheet4.Range("M" & PlantRow).Value 'XTRA
End If

End Sub
```

Figure 8. Objects Sheet 1 (PO)

For the macros, the new button macro uses the assign macro for the new button on the PO sheets. This new button will clear all the contents that are available in the PO sheets follow the codes that are assigned to, reset the currency, and automatically insert the current date for the PO date as show in Figure 9. Save button macros are same as the new button which is needed to assign the macros to the save button. This feature will save the PO details to the logbook and monitoring files automatically.

```
Sub NewBtn()

Range("B2").ClearContents 'PO#
Range("B4").ClearContents 'Supplier
Range("B5").ClearContents 'Type
Range("B8").ClearContents 'Plant
Range("K8").ClearContents 'Revision
Range("D13:I17").ClearContents 'Supplier Details
Range("J13:N17").ClearContents 'Plant Details
Range("F19:G19").ClearContents 'Requestor
Range("F21:G21").ClearContents 'ETA
Range("J21:K21").ClearContents 'JN
Range("L21").ClearContents 'Payment
Range("M21").ClearContents 'Delivery
Range("N21").ClearContents 'SST
Range("D24:L53").ClearContents 'Items
Range("O24:O53").ClearContents 'DB Rows
Range("D21:E21") = Date 'Date
Range("M61:N61") = "MYR" 'Currency

End Sub
```

Figure 9. New button macro

2.9 Flow Process of The System

A standard operating procedure is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations as in Figure 10. The system Standard Operation Procedure (SOP) starts with creating the PO by filling in the forms details in the PO

form. Then, the PO needs to print and request for approval. After the PO is approved, the PO can be saved by clicking the save button to save all the purchase details in the logbook and the delivery monitoring sheets. The approved PO will be emailed to the supplier and waiting for the delivery process. When the item is received in the warehouse, the details of the delivery will be recorded in the logbook and the delivery monitoring sheets.

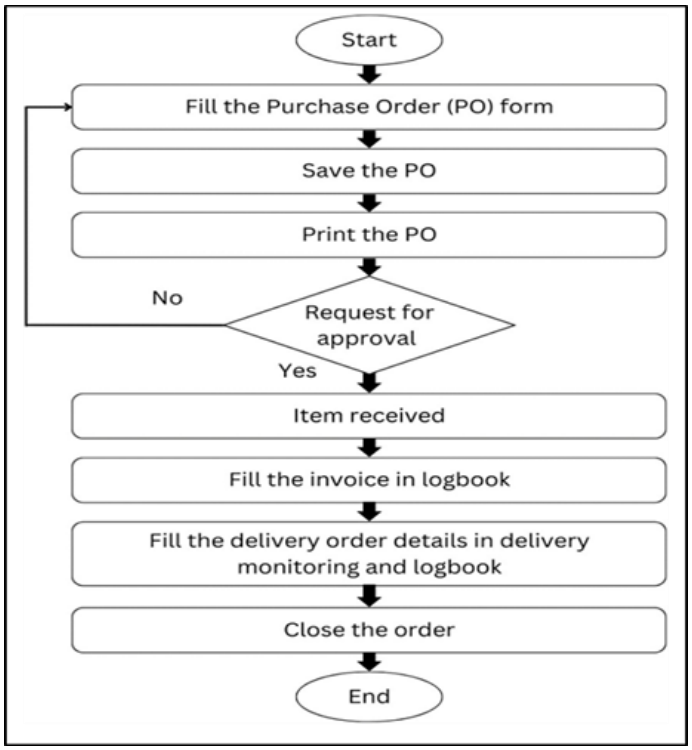


Figure 10. Standard Operation Procedure (SOP) of the system

3. Results

This research aimed to decrease the time taken to complete the order from issuing PO until the order is closed by using this new Semi-automatic Purchase Order Management System and simplify the system using a single file. After implementing the necessary changes, the system was successfully automated, resulting in significant improvements in efficiency, accuracy, and overall performance.

No.	PO Number	No. of item	Time Taken (s)					Difference (s)	% Difference
			Recent system				New System		
			PO Form	Delivery Monitoring	Logbook	Total			
1	PO/2022/508	6	48.33	88.44	65.47	202.24	61.26	140.98	69.71%
2	PO/2022/516	3	40.29	110.44	57.16	207.89	55.25	152.64	73.42%
3	PO/2022/523	7	60.71	95.90	56.00	212.61	70.36	142.25	66.91%
4	PO/2022/524	2	46.02	81.34	66.67	194.03	59.19	134.84	69.49%
5	PO/2022/530	8	63.62	150.70	59.49	273.81	73.22	200.59	73.26%
6	PO/2022/547	2	30.76	46.23	58.30	135.29	43.61	91.68	67.77%
7	PO/2022/574	2	33.05	74.99	62.87	170.91	44.98	125.93	73.68%
8	PO/2022/584	2	37.46	41.57	59.26	138.29	50.73	87.56	63.32%
9	PO/2022/585	4	45.11	66.68	61.22	173.01	59.09	113.92	65.85%
10	PO/2022/586	5	47.36	47.21	57.76	152.33	59.03	93.3	61.25%
11	PO/2022/588	10	72.19	133.61	64.92	270.72	83.77	186.95	69.06%
12	PO/2022/591	3	31.49	36.00	60.71	128.20	46.73	81.47	63.55%
13	PO/2022/593	1	30.76	21.88	55.60	108.24	41.45	66.79	61.71%
14	PO/2022/594	9	69.33	157.93	64.99	292.25	80.77	211.48	72.36%
15	PO/2022/596	8	52.71	115.65	59.76	228.12	65.37	162.75	71.34%
Total		72	709.19	1268.57	910.18	2887.94	894.81	1993.13	69.02%
Average		4.8	47.28	84.57	60.68	192.53	59.65	132.88	69.02%

Figure 11. Time taken to complete the order

The project results show in Figure 10 that the new semi-automatic system greatly reduced the time needed to complete purchase orders. On average, the time was cut by 69.02% compared to the old manual system, with improvements ranging from 61.25% to 73.68%. This proves that the project successfully achieved its goal of saving time when filling in order details. A test was done using 72 items from 15 orders. In the old system, it took about 2888 seconds to complete all the items. With the new semi-automatic system, this time was reduced to just 895 seconds, saving around 1993 seconds.

The project also looked at how long it took to complete each item. In the old system, it took 40.11 seconds per item, but with the new system, it only took 12.43 seconds per item. This shows a big improvement in speed and efficiency. The numbers clearly show that the new system is much faster, which helps increase productivity and reduces human effort. Overall, these results confirm that the new semi-automatic system is effective and has a positive impact on the work process.

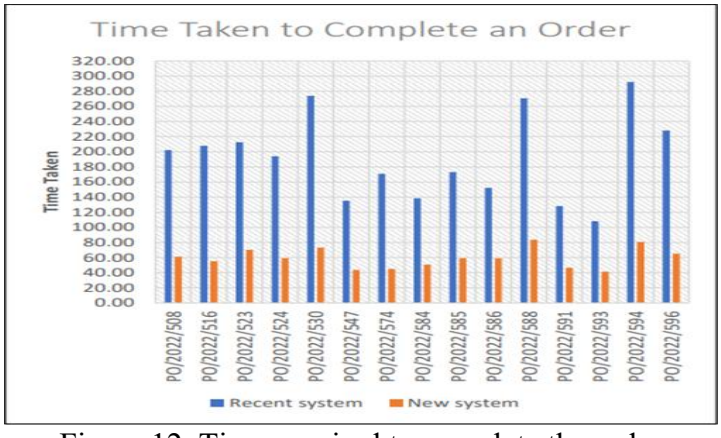


Figure 12. Time required to complete the order

The graph presented in Figure 12 illustrates the substantial difference in the time required to complete the order saving process between the old system and the new semi-automatic system. The graph uses two distinct colours to represent the two systems: blue represents the recent system (the old system), and orange represents the new semi-automatic system. The orange bar, representing the time taken by the new semi-automatic system, is significantly lower than the blue bar, representing the time taken by the recent system. This stark contrast highlights the efficiency gains achieved through the implementation of the new system. The graph serves as visual evidence of the positive impact of the automated features introduced in the new semi-automatic system. It clearly demonstrates that the new system significantly reduces the time required to complete the order saving process compared to the previous manual or recent system. The visual representation of the time difference emphasizes the advantages of the new semi-automatic system.

4. Discussion

The project focused on transforming a manual Purchase Order (PO) management system into an automated process to eliminate repetitive tasks, minimize human errors, and increase overall efficiency. The process began by analyzing the existing manual workflow and designing a new automated system capable of handling the same tasks with better accuracy and speed. Automation was applied to reduce manual data entry, especially in routine processes, allowing team members to focus on higher-level activities. A database structure was created to support the automation, ensuring that supplier details and item information were readily accessible and up to date, which helped prevent common data entry mistakes.

The improvements were implemented across several Excel sheets. In Sheet 1 (PO Sheet), macros and VBA were used to automate data saving and clearing functions, while formulas and data validation ensured that necessary fields such as supplier addresses, item descriptions, unit prices, and totals were auto-filled correctly. Conditional formatting was added to visually highlight missing or incorrect entries, prompting users to complete all mandatory information before finalizing a PO.

For Sheet 2 (Logbook), the system was designed to automatically transfer PO data directly from the PO sheet, eliminating manual duplication of entries. The logbook also included enhanced monitoring features such as order status indicators using color codes—yellow for open orders and green for closed ones. This provided a quick visual reference to track order progress.

In Sheet 3 (Monitoring Sheet), the system further simplified user workload by automatically filling in essential order tracking details, such as PO numbers, supplier info, and item descriptions. Additional fields like DO numbers (Delivery Orders) ensured that received materials were properly logged. Conditional formatting here not only tracked order status but also flagged delivery punctuality—green for on-time deliveries and red for late arrivals. New features were introduced to easily monitor pending items, which supported material planning and inventory control.

Sheets 4, 5, and 6 (Supplier, Item List, Table Layout) served as centralized databases that powered the automated functions. These sheets contained all critical supplier and item information, which the system referenced to auto-populate data into the PO forms. If a user attempted to input data not found in the database, the system would trigger an error alert, ensuring only validated data was used. This drastically reduced human error and the amount of manual work needed to complete purchase processes.

Overall, the automation initiative resulted in a system that streamlined data entry, improved data accuracy, and significantly reduced processing time. By automating most of the manual tasks, the new system enhanced productivity, simplified order tracking, and minimized the risk of ordering mistakes, thus improving the entire Purchase Order management workflow.

5. Conclusion

In conclusion, the project successfully transformed a manual Purchase Order (PO) management system into a semi-automatic system. This implementation has brought about significant improvements in efficiency, accuracy, and overall performance when it comes to saving order data in the system. The automated system developed and deployed during this project has led to a substantial reduction in the time required to complete tasks and has simplified the system by consolidating it into a single file system, transitioning from a manual to a semi-automatic approach. As a result, the system now provides a streamlined flow for ordering and saving order information into the logbook and delivery monitoring sheets. Throughout the project, several challenges were encountered. These challenges included errors in the program, incorrect data saving, and others. However, these obstacles served to enhance the understanding of the complexities involved in developing the Purchase Order Management (POM) system. With the assistance of the industrial mentor and their dedicated efforts, all these obstacles were successfully overcome, leading to the achievement of the desired outcomes. The success of the project is easily measurable, as all the objectives set out were achieved. The new system has simplified processes, reduced time wastage, and increased efficiency and productivity, all of which are crucial for any organization. By automating the PO management system, the project has not only improved the accuracy and speed of order data entry but has also reduced the likelihood of human error. This leads to better decision-making, improved resource allocation, and enhanced customer satisfaction. Overall, the project's successful transformation of the manual PO management system into a semi-automatic system has brought numerous benefits to the organization. The improvements in efficiency, accuracy, and overall performance will undoubtedly contribute to the organization's growth and success in the long run.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the author(s) used OpenAI's ChatGPT to assist in improving the readability and language of the text. All content generated by ChatGPT was subject to thorough review, editing, and revision by the author(s) to ensure its accuracy, completeness, and alignment with the research objectives. The author(s) take full responsibility for the integrity and content of the published work. This declaration complies with ICGESD 2025 guidelines on the use of generative AI in scientific writing.

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