

Improving the Purchasing Order Process of Model Auto and Equipment Supplies Inc. Using an Enterprise Resource Planning (ERP) Software

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Abstract

Enterprise Resource Planning software is a very essential tool for enterprises in the digital age. The study was conducted for Model Auto & Equipment Supplies Inc., which supplies and deals with all kinds and types of automotive parts, whose purchasing processes are lacking in terms of automation and report generation. The researchers designed and simulated a future state of the purchasing processes that can generally improve the purchasing process with the help of an ERP system. The results showed that the future state of the processes can automatically generate significant reports by the ERP Software enabling MODEL to monitor and evaluate themselves and their suppliers, this feature of the ERP software will eliminate repetitive tasks. The Purchasing Item/Materials process's VS ratio risen by 37.738%, from 57.500% to 95.238%, and the Request for Quotation (RFQ) Document Creation process the VS ratio is expected to rise by 8.967%, from 34.783% to 43.750%. Lead time for Purchasing Item/Materials process was reduced by 19 minutes while 7 minutes was reduced from the Request for Quotation (RFQ) Document Creation process. The physical storage will be replaced by a cloud storage that will eliminate the issues that the current physical storage of MODEL is facing.

Keywords

Enterprise Resource Planning, Purchasing Process, SAP S/4HANA

I. INTRODUCTION

1.1 Background of the Study

Model Auto Supply and Equipment is a company that sells automotive parts and equipment. The company operates manually within terms of recording purchase information and transactions with their suppliers, bank deposits and withdrawals, check/cheque issuance, as well as paying off bills and purchases. The issue that the purchasing department faces would be the old methods of the company which also led to their lack of automation and System Integration on their processes. The company's purchasing department still records files manually for processes such as the purchasing of materials and requesting for quotation, they record them manually in a columnar book and excel for the submission to their accountant which is usually late resulting in penalties when submitting late reports to the Bureau of Internal Revenue and redundancy of tasks. The old filing cabinets of Model led to poor organization of files. Making the process of looking for appropriate files difficult. The company is also lacking when it comes to Report generation not just on the purchase records but also other forms of reports about the purchasing process such as Purchase Order records by each supplier that might be useful for evaluating suppliers and monitoring the purchasing habits of the company itself. MODEL Auto Supply and Equipment must implement an Enterprise Resource Planning Software in order for them to access a wide variety of reports and avoid the nuisance of repetitive tasks such as recording the purchases on a book and on excel both with poor filing systems. SAP s/4HANA, an ERP Software is a suitable platform to be integrated and implemented on the company's operation since it provides resiliency during uncertainty, by utilizing this software it would provide up-to-date deliverables and reports that would help the company's decision-making. Its features include *Streamlined reporting eliminates data*

duplication in such systems. *Integrated business planning*, *Cash management* help the company to manage the bank accounts, position, liquidity, maximize working capital. *Financial reporting*, which drills down the financial reports to provide in-depth financial performance indicators.

1.2 Problem Statement

Currently, the problems that MODEL Auto and Equipment Supplies Inc.'s purchasing department faces are the lack of automation and system integration.

1. Insufficient purchasing reports leading to lack of supplier evaluation.
2. Tedious and time-consuming retrieval of documents due to unorganized files.
3. Late submission of purchasing records to the accountant due to manual recording which also causes tasks to be repetitive such as recording purchases on a columnar book and recording purchases on excel both with no proper filing or organization system.
4. Repetitive tasks pose risks to mistakes, discrepancies, and errors when recording purchasing process information.

1.2.1 WHY-WHY DIAGRAM

These are the root-cause analysis for the 3 main problems of the purchasing processes of Model Auto Equipment and Supplies using the Why-Why diagram.

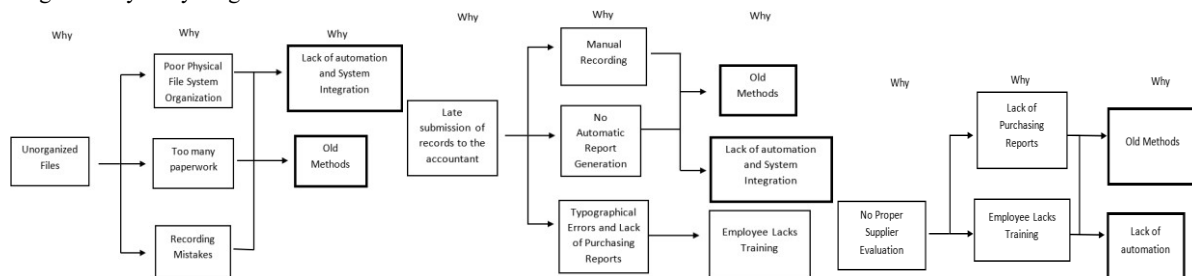


Figure 1. Why-Why Diagrams of the Problems of the Purchasing Process

The researchers utilized the Why-Why Diagram (figure 1) above to further explain why the Inefficient Purchasing Process occurs in our chosen company. The Why-Why Diagram shows the sequencing of problems discovering their root cause and the subproblems related to it. The main problem is Inefficient Purchasing Process which is divided into 3 problems which are the following: first is unorganized files wherein the documents are prone to get lost since it is not properly organized consuming more time in searching for the right document. Second is the late submission of the record to the accountant since it is done by manual recording, and there is no automatic generation, and some have typographical errors, and it lacks purchasing reports since the company has old methods and lacks automation. Third would be that there is no proper supplier evaluation, it is due to the lack of purchasing reports, and the lack of employee training since MODEL have old methods and lack automation. The root cause identified is the lack of automation and system integration and old methods which causes the tedious manual processes and repetitive tasks on the current purchasing processes of MODEL Auto and Equipment Supplies.

1.3 Objectives

The project aims to improve MODEL Auto and Equipment Supplies Inc. by integrating an ERP system that will provide them better handling with the business transactions focusing on purchasing processes.

Specifically, this project aims to accomplish the following objectives:

1. Develop a future state of purchasing processes that can generate various purchasing reports that can be significant for the company and allow them to evaluate their suppliers.
2. Reduce the time needed for purchasing processes by replacing the tedious manual recording processes with the help of an ERP system.
3. Improve the file organization of the company with the help of an ERP system.
4. Reduce the redundancy of processes by integrating an ERP system.

II. RELATED LITERATURE

The Enterprise Resource Planning (ERP) system is an enterprise information system made to merge and enhance the business processes and transactions in a corporation. The ERP is an industry-driven concept and system and is universally accepted by the industry as a practical solution to achieve merging enterprise information systems. The academic research community has been coming up to the field in various ways. The articles under this theme address various topics of using the ERP system during the post-implementation era differ from end-user acceptance to end-user satisfaction, to business process reengineering after ERP implementation, to uncertainty management, to particular functions such as designing return material process and handling

Sarbanes-Oxley requirements. The early 1990s witnessed a trend where every organization wanted to be productive and develop a competitive advantage through cost leadership effectively utilizing resources from the support department. ERP integrates the business processes of department functions and departments into one unified system. In this integrated system, different components of software and hardware take care of different business processes. The Implementation of Business Process Reengineering As more organizations undertake business process reengineering (BPR), issues in implementing BPR projects become a major concern. This field research seeks empirically to explore the problems of implementing reengineering projects and how the severity of these problems relates to BPR project success. Based on past theories and research related to the implementation of organizational change as well as field experience of reengineering experts, a comprehensive list of sixty-four BPR implementation problems was identified the central importance of change management in BPR implementation success. Resolutions of problems in other areas such as technical competence and project planning were also determined to be necessary, but not sufficient, conditions for reengineering success. Further, problems that are more directly related to the conduct of a project such as process delineation, project management, and tactical planning were perceived as less difficult, yet highly related to project success. This situation was also true for human resource problems such as training personnel for the redesigned process.

Dynamic Process Improvement A business process is a set activity that defines to achieve organization goals and generate output that delivers value to meet customer needs. Sometimes the business process in an organization is less than optimal and the organization is currently faced with the highest rivalry and market change. Consequently, organizations need to continuously improve their underlying process to achieve the highest quality of process with reduced cost and cycle time to deal with market competition. The purposes of business process improvement (BPI) are to recognize organization objectives and vision and also increase organization productivity, work, and responsibility to meet client needs by reducing cost, improving the service or product quality, availability, and effectiveness. Moreover, BPI became extremely important because it is a way to ensure the better transformation of the process (i.e. function and structure) of organization, more competitive and successful organizations. Organizations continuously find ways to improve their business processes. For the organizations to improve their business process need an effort, they are trying to continually increase both the service quality and competitive advantages. To obtain BPI constantly, it's important to examine the current process and look for another choice of improving the business process. High Volume Automotive Manufacturing The development costs for automotive models have increased over the years due to the unavoidable resource costs such as raw material, labor, and services. Hence, automakers are extensively doing research on how to reduce these costs. One attempt is to reduce the number of platforms, as suggested by Kim (2003). The idea is to have multiple vehicle variants of a single platform. By implementing this concept, many parts can be shared between car models which reduce the tooling costs tremendously. High Volume Automotive Manufacturing (HVAM) involves many high technology tools ranging from such as dies, jigs, and robots. Using this platform commonization technique undoubtedly reduces cost, time to market, and quality as well as more choice to end-users. On the specific manufacturer's approach, according to Cleveland, Toyota has implemented an approach known as set-based concurrent engineering. The approach is basically a set of databases of designs for various car components. By applying this approach, multiple design alternatives are created for each subcomponent instead of a single design variant. They can easily change the design by selecting the alternative if the chosen design fails during simulation performance.

Low volume automotive manufacturing sector globally is increasingly becoming a competitive industry that requires new car models at a lower cost, but at higher quality. Current market trends require faster product development, lower cost, and higher quality products. Niche car models such as luxury, sports, and special purpose vehicles are one of the viable strategies to sustain the market choices, which is achieved through Low Volume Automotive Manufacturing (LVAM), defined as 25,000 – 30,000 units per annum. The normal route of car-making processes is not suitable to be implemented for LVAM, because the normal route involves higher costs and longer project scheduling. Niche models of LVAM require high customization, especially when related to design concepts, manufacturing methods, and suppliers. The automotive design normally requires experts who know the entire automotive production system starting from design concept, tooling making, and production requirements. To develop these experts requires time, resources, and training that are normally the manufacturer's bottleneck. According to Udin, Khan and Wibisono, and Nawawi, it is essential to have a systematic tool for generic design in the automotive industry such as a Knowledge-Based System in order to achieve the manufacturing demands and the high standards of production quality. Automotive design tools. In the automotive industry, there are two types of designs, namely product design and tooling design. Product design is related to the parts of the entire automotive body and chassis structure such as side panel, doors, hood, doors that total up to more than 300 parts. Tooling design is related to the tools required for transforming the material into parts such as dies and molds. Tooling design is also required for body assembly fixture fabrication. Normally, automotive manufacturers design the parts according to their own specifications, systems, and requirements. According to Trappey and Hsiao, upon completion of the product design, Primary Manufacturing Enterprise (PME) or the automotive manufacturer will find suppliers to fulfill the product design with detailed tooling design. The suppliers or System Manufacturing Company (SMC) will design according to the requirements, fabricate the

tools and produce the parts. SMC also has collaborative suppliers to supply components, parts, and materials. The system involves a design phase and production phase that works in a close loop such that PME sets the system requirement and production order, SMC and suppliers will respond accordingly.

III. METHODOLOGY

3.1 Conceptual Framework

Table 1. Conceptual Framework

Input	Process	Output
Interview Profile of MODEL - Company Background - Defining current Business Process - Problems that they have encountered	Root Cause Analysis of the current process of the purchasing process Identifying and analyzing Improvement Opportunities Simulation of the current state and the future state of the purchasing processes	Design of the future purchasing processes Development Plan for Future State Changes

Table 1 shows the conceptual framework of the study. In the input, the group conducted an interview with one of the employees of MODEL and gathered the necessary information like the background of the company, their current business processes, and the such. In terms of processing the information, the group made a root cause analysis to help them to determine the root problem in the purchasing process and then followed by identifying and analyzing the improvement opportunities that can be made with the current purchasing process of MODEL. After analyzing, the group came up with a draft for the future purchasing processes then conducted simulations to see the difference between the current and future process in terms of convenience, and the estimated time in finishing the process. For the output, the group was able to come up with the design of the future purchasing process and a development plan for the future state changes which can be implemented if it will be proposed with the employees of MODEL.

3.2 Analysis of Current and Future State using Flow Process Chart and Swimlane

The Swimlane Diagram was used to identify the flow of the current and future states of the purchasing processes of MODEL Auto and Equipment Supplies as well as the personnel or department involved in the process. The Flow Process Chart was used to evaluate the efficiency of the process.

3.3 Development and Analysis of Future State

The researchers used SAP s/4HANA for simulation of the future state. SAP S/4HANA is the fourth version of SAP Business Suite. It was based on SAP ECC and was built from the ground up, in order to take advantage of SAP HANA's capabilities in data analytics. S/4HANA was designed so that it can accommodate larger data than SAP ECC. S4/HANA not only focuses on recording data but also provides users with active decision support in real-time. S/4HANA also brings simplification to the table as it has a core architecture principle called "the principle of one" meaning, the simplification of the features and functionalities to reduce redundancy and overlaps. S/4HANA accomplishes this principle by the depreciation of redundant data models, UIs, frameworks, etc. S/4HANA also has semantic compatibility with SAP ERP, which allows for transition paths that are attainable within a reasonable timeframe. Many of SAP EPR's extension points remain available which means that users of SAP ERP will have the least possible disruption when transitioning to SAP S/4HANA

3.4 Development of Future State of Purchasing Processes

In phase 1 of developing the future state of the purchasing process, the group created their company code, business area, empty chart of accounts, controlling area, credit control area, variants for open posting periods, account groups, tolerance groups for employees, and the such. These details are basically the needed information in establishing MODEL in the ERP software as shown in Figure 2 below.

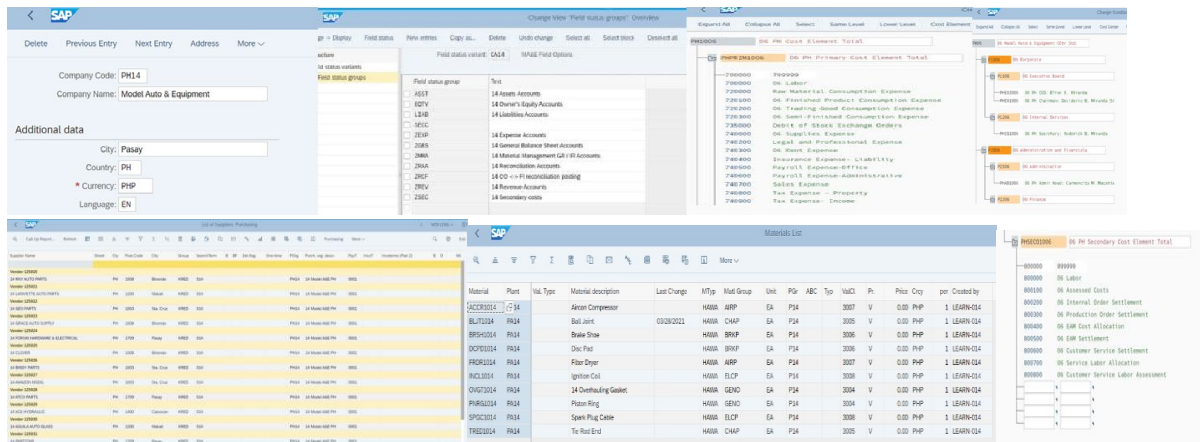


Figure 2. SAP Configuration

SAP S/4HANA also includes the creation of balance sheets, profit, and loss G/L accounts, standard hierarchy, primary cost elements, secondary cost elements, element groups, and opening posting periods as shown above in Figure 3. On this part, it is still part of defining the MODEL as to who are the employees of MODEL, the cost elements that they will be using in their transactions, and the G/L accounts that they will be checking once they start using the ERP software in terms of their financial situation. In phase 2 which is configuring the materials management process, the researchers defined the material groups, defined the valuation process, defined the plants, created purchasing groups, assigned purchasing organization to company code, assigned plants to company code, assign purchasing organization to plants, grouped the valuation areas, assigned and activated material ledger types to valuation area, created job production startup, defined the tax, configured automatic postings, defined default values for inventory and plants, created master data, and created vendors as shown in Figure 2 above.

IV. RESULTS AND DISCUSSION

4.1 Current Processes

Current System Flowchart for Model's Purchasing Item/Materials Process

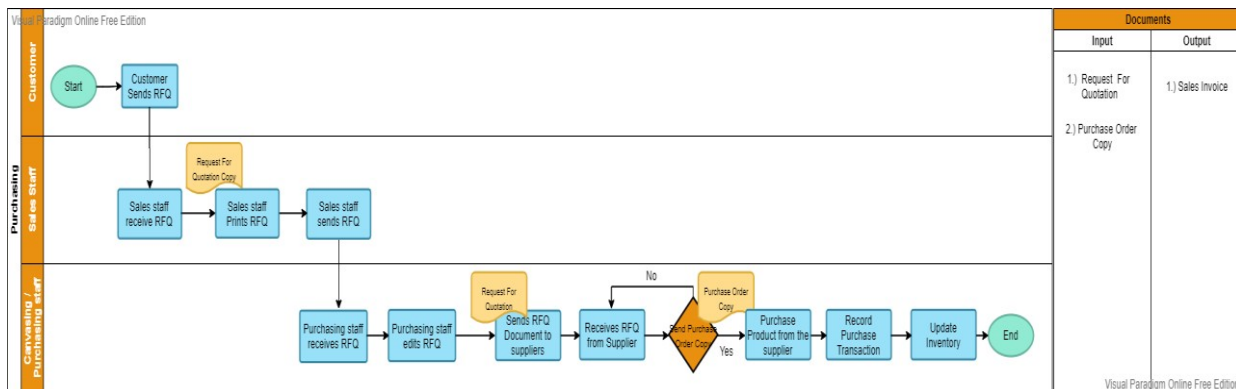


Figure 3. Current System Flowchart for Model's Purchasing Item/Materials Process

Figure 3 above shows the swimlane diagram for the purchasing process. The purchasing process consists of three parts, namely the sales staff, purchasing staff, and the customer. The process starts with the customer creating a purchase request and sending it to the email of MODEL, the sales staff that handles the interactions between the company and the customers would regularly check the email to see if there are any new purchase requests. After acquiring the purchase request from the customer, the sales staff will send a copy of the purchase request to purchase staff which is a non-value adding process since it would much more efficient if the purchasing department has access to the purchase request as soon as it was received so that they would be able to immediately provide the cost of the desired products of the customer and send a quotation to the sales staff. After acquiring the price quotation from the purchasing staff, a value-adding process will commence as the sales staff will then send a copy of it to the customer. If the customer declines the quotation the process will start back to the sales staff to get another price quotation to be sent to the customer. If approved, the customer will send a purchase order to the sales staff. The sales staff will then proceed to send a copy of the order to the purchasing department which is also a non-value adding process since it can be removed if the purchasing department has direct access to the PO document as soon as it was received. The credit and collection staff will then create a receipt

and collect the payment when it is due, which is a value-adding process since most payments are on credit which makes the customer confident to order at Model and that ends the sales process.

Request For Quotation (RFQ) Document Creation Process

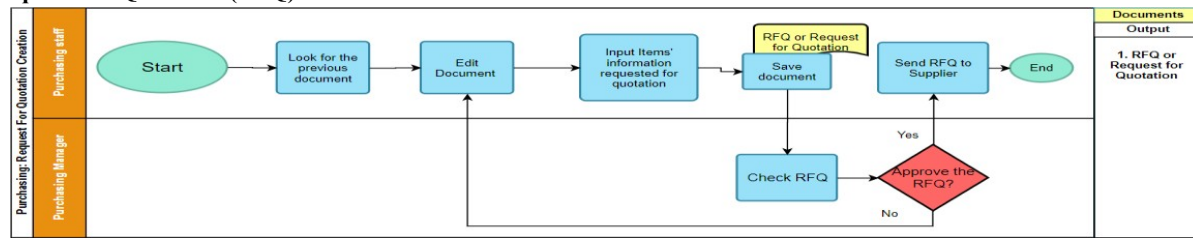


Figure 4. Current Request For Quotation (RFQ) Document Creation Process

Figure 4 above shows a swimlane diagram for the document creation of Request for Quotation. The process begins with the purchasing staff looking for the previous document then edits the document, right after editing the document he/she will input the following information of the items for quotation and save the document. The saved document will then be passed to the purchasing manager for him/her to validate if the information that was inputted on the file is correct and similar to the request that was created and if the RFQ was declined it will then be returned to the purchasing staff and edit the document, input the revisions that were made, and will be sent again to the purchasing manager for validation. However, if the Purchasing Manager approves the RFQ it will be then sent to the purchasing staff once again to send the final and validated RFQ to the supplier. The output of this process is the Request For Quotation.

4.2 Processes' Future States

Purchasing Item/Materials Process

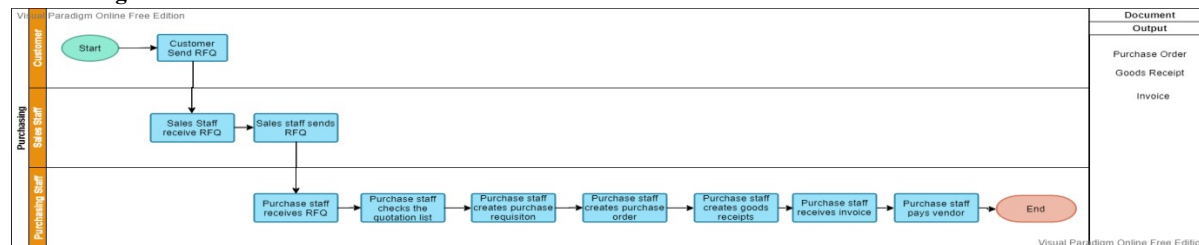


Figure 5. Future Purchasing Item/Materials Process

The swimlane diagram shown above (figure 5) is about the probable future state of Purchasing Item or Material Process. The process begins with the customer sending an RFQ to the Sales staff, and validates if the information is complete he/she will then send the RFQ to the Purchasing Staff. The Purchasing Staff will then check the quotation list for verification, then creates purchase requisition, purchase order, creates the receipt of the goods, and pays the vendor. The output of this process is the purchase order, goods receipt, and invoice. Providing financial activities is to record a series of purchase transactions, which are used to record any capital expenditures that the registered company has obligations or owes to the supplier. (Sunarya, P. A., Nawi, M. N. M., & Rahayu, S., 2017). Having a purchase report will help the company's income and expenses wherein it can easily record and analyze many purchase transactions.

Request For Quotation (RFQ) Document Creation Process

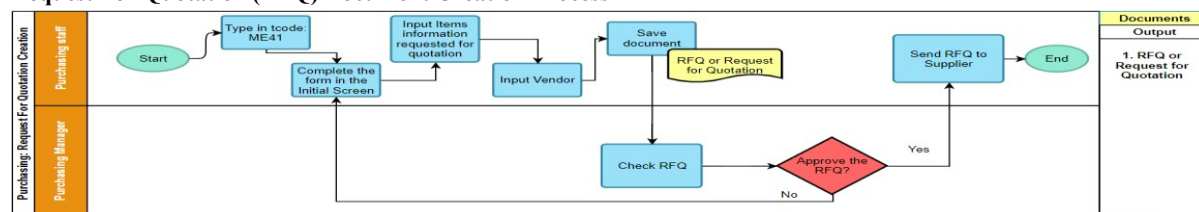


Figure 6. Future Request For Quotation (RFQ) Document Creation Process

In the Swimlane shown above (figure 6) is the Request for Quotation Creation (RFQ) in purchasing, wherein the purchasing staff encodes the tcode which is ME41 to open the *Create RFQ: Initial Screen* to input the details and complete the form, and the purchasing staff inputs the details of the items information requested for quotation followed by the vendor's details or information and after being done, the purchasing staff saved the document. When the document is saved, the purchasing manager checks the RFQ and decides if the RFQ is approved or not. If the RFQ is approved, the purchasing staff will send the RFQ to the supplier. On

the other hand, if the RFQ is rejected when the purchasing manager checks it, it will return to completing the form in the initial screen and repeat all the succeeding procedures until it was approved and successful. The business process is redesigned to manage uncertainty and certain functions. Cost can be reduced through the effective use of support resources. ERP merges department business processes and department functions into one system (Fine, C. H., Chen, Y., Shum, S., et al., n.d.). Therefore, the company must continuously improve its basic processes in order to achieve the highest process quality with reduced costs and cycle times and to respond to market competition. (Ganesh, K. 2014).

Consignment Process

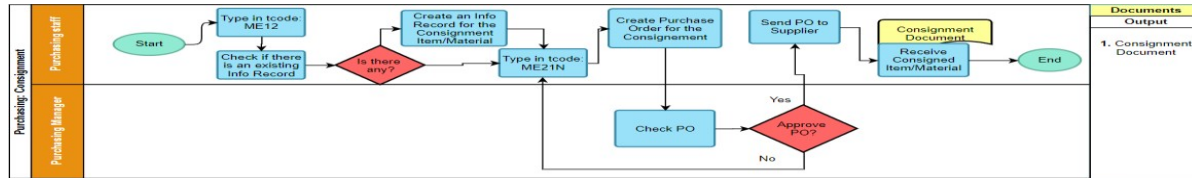


Figure 7. Consignment Process

In the Swimlane shown above (figure 7) is the Consignment in purchasing, wherein the purchasing staff encodes the tocode which is ME12 to open the *Change Info Record: Initial Screen* and input the details needed to check if there is an existing Info Record if there is no existing Info Record, the purchasing staff will then create an Info Record for the Consignment Item or Material. On the other hand, if there is already an existing Info Record, the purchasing staff will then encode the tocode which is ME21N to open the *Create Purchase Order* screen where he can create a purchase order for the consignment. After creating a purchase order for the consignment, the purchasing manager will check the purchase order, if it is approved, the purchasing staff will send the purchase order to the supplier and will receive consigned item or material but if the purchase order is rejected, the purchasing staff will encode the tocode ME21N again and repeat all the succeeding processes until it was approved and successful. MODEL does not have a consignment document instead the payables or credit items are placed in their quotation and invoice. This process will improve the purchasing process of MODEL by saving on inventory costs as MODEL won't have to pay for the consigned item/material until it is sold to a customer.

Evaluation of Processes

This part discusses the evaluated efficiency of the purchasing processes using the Flow Process Chart Tool. This analysis was done in both the current and future states of the processes.

4.3 As-is processes

Flow Process Chart for Current Purchasing Item/Materials Process

Total VA	7		Total NVA	3		Total ENVA	3	
VA Time	23	Minutes	NVA Time	8	Minutes	ENVA Time	9	Minutes
Distance traveled	2	Meters	Lead Time	40	Minutes	VS Ratio	57.500%	

Figure 8. FPC for Current Purchasing Item/Materials Process

Figure 8 above is the current purchasing process of MODEL, wherein it is composed of 23 activities and out of those activities are Non-value adding or it can be removed from the process in order for the process flow to get faster such as the sales staff receiving the RFQ then will print it then send it to the purchasing staff which can be automated and can directly access by the purchasing staff. The current process takes about 40 minutes of the time in covering the whole process wherein the 8 minutes are from NVA which can be reduced, they are also considered as delays. In the operations it is mainly about getting the quotation of the customers and having a bargain with the supplier finally, purchasing the product itself.

Flow Process Chart for Current Request For Quotation (RFQ) Document Creation Process

Total VA	2		Total NVA	1		Total ENVA	4	
VA Time	8	Minutes	NVA Time	5	Minutes	ENVA Time	10	Minutes
Distance traveled	0	Meters	Lead Time	23	Minutes	VS Ratio	34.783%	

Figure 9. FPC for Current Request For Quotation (RFQ) Document Creation Process

Figure 9 above is the process chart showing the current Request For Quotation (RFQ) Document Creation Process of MODEL wherein it has a total of 7 activities and out of those activities there are 1 non-value adding (NVA) activities that can be removed from the process to improve the proper file system and template. The current process takes a total of 23 minutes of the time covering the whole process wherein the 5 minutes are from NVA which can be reduced since it causes delays. In the operations, it is mainly about editing and inputting the information requested for the quotation and being sent to the supplier.

Current Reports and Documents of MODEL

Figures 10 and 11 below are the current form of their purchase records, purchase order and request for quotation.

Purchase Transaction Records

Item	Description	Supplier	Price	VAT
12/00000000	LIBRETTI AUTO PARTS	LIBRETTI A. S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1700.000	1700.000
12/00000000	HOSHOKO INDUSTRIAL SUPPLIES	HOSHOKO S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	400.000	400.000
12/00000000	ALFA ROMEO LUBRICANTS	ALFA ROMEO S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	ANGULA AUTO GLASS	ANGULA S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	EER RAME	EER S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	BARRETTA	BARRETTA S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	NAVIGARE PARTS INC.	NAVIGARE PARTS INC. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	LABRALPH AUTO PARTS	LABRALPH AUTO PARTS - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	PROKAWA	PROKAWA S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000
12/00000000	RECKY	RECKY S.P.A. - VIA S. ANTONIO 100 - 00100 ROMA	1000.000	1000.000

Figure 10. Purchases Record

Purchase Order and Request For Quotation



Figure 11. Purchase Order and Request for Quotation Documents

4.4 To-be Processes

These future states' flow process charts' data were gathered by configuring and simulating the process through SAP s/4HANA that will serve as the ERP Solution Software for MODEL.

Flow Process Chart for Future Purchasing Item/Materials Process

Total VA	8		Total NVA	0		Total ENVA	1	
VA Time	20	Minutes	NVA Time	0	Minutes	ENVA Time	1	Minutes
Distance traveled	0	Meters	Lead Time	21	Minutes	VS Ratio	95.238%	

Figure 12. FPC for Future Purchasing Item/Materials Process

Figure 12 above is the future process of the purchasing item/processing materials are composed of 9 activities and takes only 21 mins to finish the whole process. Wherein the customer just need to receive the RFQ and then the purchasing will do the rest such as checking the quotation list, creating purchase requisition, purchase order, good receipts, receiving the invoice, and then paying the vendor, then the transaction will be automatically recorded, and there are no papers included since it is all in the ERP system that was used. All of the processes are part of the operation and the only thing that is in inspection is the approval of purchase requisition.

Flow Process Chart for Future Request For Quotation (RFQ) Document Creation Process

Total VA	3		Total NVA	0		Total ENVA	5	
VA Time	7	Minutes	NVA Time	0	Minutes	ENVA Time	9	Minutes
Distance traveled	0	Meters	Lead Time	16	Minutes	VS Ratio	43.750%	

Figure 13. FPC for Future Request For Quotation (RFQ) Document Creation Process

Figure 13 above shows the flow process chart of the future request for quotation part, wherein it is composed of 8 activities and takes only 16 minutes to finish the whole process. Most of the time the purchasing will just use the ERP in order to input the needed information in getting a quotation; the information about the vendors is also included in the process. The value category that can be seen in the process are the ENVA and VA since it is all-important in the process. Most of the processes are mainly operation and then in terms of checking the RFQ document and approving the said document are part of the inspection.

Flow Process Chart for Consignment Process

Total VA	3		Total NVA	0		Total ENVA	2	
VA Time	12	Minutes	NVA Time	0	Minutes	ENVA Time	4	Minutes
Distance traveled	0	Meters	Lead Time	17	Minutes	VS Ratio	70.588%	

Figure 14. FPC for Consignment Process

The process chart above (figure 14) is the future consignment process wherein it is composed of 6 activities and it takes 17 minutes to finish the consignment process. The Essential Non-Value Added (ENVA) here is the raw material warehouse. This process, it is about improving the purchasing process of MODEL by accessing the Info records and creating the info record followed by creating a purchase order for the consignment material. After creating the purchase order it will be sent to the supplier and the purchasing staff will then receive the consigned materials that he ordered. By improving the purchasing process, it removes all the non-value adding activities to have a smoother and faster transaction.

4.5 Significant Reports Provided by ERP SAP S/4 HANA

These are the reports generated by SAP S/4 HANA during the simulation of purchase processes. Each report's significance will be discussed.

Purchasing Documents by Document Number

This report below (figure 15) shows all the purchase orders of the company. Including the status of the purchase order whether there is still to be invoiced or to be delivered. It also includes the Order Group This report would greatly help in performing comparisons between Purchase Orders. Observing the company's purchasing habit.

The screenshot displays three panels of SAP purchase order data. Each panel shows a list of items with columns for Item, Material, Type, Supplier, Name, Short Text, PGP Order Date, Mat. Group, Order Qty, Un, Net Price, Curr., and per Un. The items listed include Piston Ring, Ball Joint, Brake Shoe, Spark Plug Cable, Overhauling Gaske, Tie Rod End, Disc Pad, and Ignition Coil. The status for each item is indicated as 'Still to be delivered' or 'Still to be invoiced'.

Figure 15. Purchase Documents by Document Number Report

Purchasing Documents per Supplier Report

This figure 16 report shows the purchase orders for a specific supplier or vendor. Including the plant, quantity, status, and the materials involved. This can be used to compare different purchase orders issued to a specific supplier. The company can use this to evaluate its suppliers by monitoring their responses to these purchase orders.

PO	Type	Supplier	Name	PGP	Order	Date
4500000088	NB	125065	06 SIMPLEX	P06	05/05/2021	
00010	ACCR1006		06 Aircon Compressor AIRP			
K	PA06 TG06			4 EA	0.00 PHP	1 EA
	Still to be delivered			0 EA	0.00 PHP	0.00 %
	Still to be invoiced			0 EA	0.00 PHP	0.00 %

Figure 16. Purchase Documents by Supplier Report

Purchasing Documents for Material

This document (figure 17) will help the purchasing department to see the list of the items that they ordered from their vendors and they can also see the list of the product by its item material number. This document can also be used in monitoring the products and its current status if it is already delivered or if it needs to be invoiced, once it has been delivered and invoiced then it will also reflect in the document.

PO	Type	Supplier	Name	PGP	Order	Date
4500000088	NB	125065	06 SIMPLEX	P06	05/05/2021	
00010	ACCR1006		06 Aircon Compressor AIRP			
K	PA06 TG06			4 EA	0.00 PHP	1 EA
	Still to be delivered			0 EA	0.00 PHP	0.00 %
	Still to be invoiced			0 EA	0.00 PHP	0.00 %
4500000012	NB	125052	06 BINDY PARTS	P06	04/22/2021	
00030	DCP01006		06 Disc Pad BRKP			
	PA06 TG06			10 EA	430.00 PHP	1 EA
	Still to be delivered			0 EA	0.00 PHP	0.00 %
	Still to be invoiced			0 EA	0.00 PHP	0.00 %
00040	INCL1006		06 Ignition Coil ELCP			
	PA06 TG06			20 EA	1,500.00 PHP	1 EA
	Still to be delivered			0 EA	0.00 PHP	0.00 %
	Still to be invoiced			0 EA	0.00 PHP	0.00 %
00019	OVG1006		06 Overhauling Gaske GEN0			

Figure 17. Purchase Documents by Material Report

General Ledger Balance Accounts

This balance sheet (figure 18) below would greatly help not just the purchasing department but the financial department as well. This could be used to evaluate and monitor business transactions and be submitted to the decision-makers of the company with a summary. Trends can be discovered from these balances as well as the checking of your company's liabilities such as accounts payables.

Status	Assignment Reference	Journal Entry	Journal Entry T...	Posting Date	Posting Key	Amount in CC Crpy
Company Code: PH14 - Model Auto & Equipment						
G/L Account: 100000 - Bank Account						
✓	20210408	100000001	SA	04/08/2021	50	-1,500.00 PHP
✓	20210408	100000002	SA	04/08/2021	50	-3,000.00 PHP
✓	20210408	100000004	SA	04/08/2021	50	-3,000.00 PHP
✓	20210419	150000000	KZ	04/19/2021	50	-76,600.00 PHP
						-84,100.00 PHP
						-84,100.00 PHP

Figure 18. Balance Sheet

Stock Overview

This report (figure 19) below shows the stock levels of your materials. This report also shows the status of your materials whether they are of Unrestricted Unit, in Transit or Transfer, under Quality Inspection, of Restricted-Use, Blocked or Returns by Plant. This report also shows the total amount or value of each material based on how much your company paid for them. This will be useful for MODEL in monitoring their stock levels and determining their most valuable or least valuable material based on its total amount.

Material	Material description	Plant Name 1
BLJF1014	Ball Joint	PA14 14 Plant Pasay
TG14	0 EA	0
	0.00 PHP	0.00
BS031014	Brake Shoe	PA14 14 Plant Pasay
TG14	0 EA	0
	0.00 PHP	0.00
DS031014	Disc Pad	PA14 14 Plant Pasay
TG14	10 EA	0
	4,300.00 PHP	0.00
INCL1014	Ignition Coil	PA14 14 Plant Pasay
TG14	20 EA	0
	31,800.00 PHP	0.00
OVG11014	14 Overhauling Gasket	PA14 14 Plant Pasay
TG14	50 EA	0
	0.00 PHP	0.00

Figure 19. Stock Overview Report

Material Document List Report

This report (figure 20) below shows the materials your company currently has in the inventory. This also shows the date the material document record was posted, and to which plant it is located. This can be utilized for monitoring your plants and storage locations whether your purchased materials have been recorded at the right date and quantity. You can also determine here especially if the company has many plants or branches which one has the most or the least number of stocks available and perform transfers to maintain each and make sure that no material is not moving or not selling.

Material	Material description	Plant Name 1
DCPD1014	Disc Pad	PA14 14 Plant Pasay
TG14 101	5000000022 3 04/19/2021	10 EA
INCL1014	Ignition Coil	PA14 14 Plant Pasay
TG14 101	5000000022 4 04/19/2021	20 EA
OVG11014	14 Overhauling Gasket	PA14 14 Plant Pasay
TG14 101	5000000022 1 04/19/2021	50 EA
TRED1014	Tie Rod End	PA14 14 Plant Pasay
TG14 101	5000000022 2 04/19/2021	30 EA

Figure 20. Material Document List Report

Consigned Material/Item Record

This report (figure 21) below shows all the consigned documents. This will be useful for monitoring whether the company still has liabilities on any of their suppliers, how much and the date it was posted. They can also check the document information once they click the material document number.

CoCode	Vendor	Mat. Doc.	MatYr	Item	Document Date	Plant	Material	Qty Withdrawn	Un	Amount	CrCY	DocumentNo	Year	InvItem	Information text	Qty in PUoM
PH14	125033	4900014080	2021	1	04/29/2021	PA14	ACCR1014	4	EA	46,796.00	PHP				No tax information found	

Figure 21. Consignment Report

4.6 Comparison of Improvement

Using the Flow Process Chart’s efficiency evaluation results, the current and future states were compared and discussed here.

Purchasing Item/Materials Process

Total VA	7		Total NVA	3		Total ENVA	3	
VA Time	23	Minutes	NVA Time	8	Minutes	ENVA Time	9	Minutes
Distance traveled	2	Meters	Lead Time	40	Minutes	VS Ratio	57.500%	

Figure 22. Current State

Total VA	8		Total NVA	0		Total ENVA	1	
VA Time	20	Minutes	NVA Time	0	Minutes	ENVA Time	1	Minutes
Distance traveled	0	Meters	Lead Time	21	Minutes	VS Ratio	95.238%	

Figure 23. Future State

By comparing the current state (figure 22) and the future state (figure 23) the proposed future process flow for the Purchasing Item/Materials process the VS ratio is expected to rise by 37.738%, from 57.500% to 95.238%. Reduce lead time by 19 minutes and remove the distance traveled. These positive results are possible due to the removal of the non-value adding steps namely, “Sales Staff receives RFQ”, “Sales staff print RFQ”, and “Sales staff send RFQ” which has a total of 8 minutes as these processes will not be necessary once the ERP solution is implemented, MODEL could set the purchasing department responsibility to immediately receive and respond to RFQs coming from customers. Together with the optimization of other steps when integrated with an ERP Software.

Request For Quotation (RFQ) Document Creation Process

Total VA	2		Total NVA	1		Total ENVA	4	
VA Time	8	Minutes	NVA Time	5	Minutes	ENVA Time	10	Minutes
Distance traveled	0	Meters	Lead Time	23	Minutes	VS Ratio	34.783%	

Figure 24. Current State

Total VA	3		Total NVA	0		Total ENVA	5	
VA Time	7	Minutes	NVA Time	0	Minutes	ENVA Time	9	Minutes
Distance traveled	0	Meters	Lead Time	16	Minutes	VS Ratio	43.750%	

Figure 25. Future State

By comparing the current state (figure 24) and the future state (figure 25) the proposed future process flow for the Request For Quotation (RFQ) Document Creation process the VS ratio is expected to rise by 8.967%, from 34.783% to 43.750%. Reduce lead time by 7 minutes and remove distance traveled as well. These positive results are possible due to the removal of the 5-minute non-value-adding step namely, “Purchasing Staff Looks for the Previous RFQ Document” as these processes will not be necessary once the ERP solution is implemented, and MODEL would be able to record their supplier’s information together with the materials information as well making it easier and efficient to create a Request for Quotation document.

Virtual/Cloud Storage

Physical file storage is what MODEL is currently utilizing which occupies a lot of physical space in their office as they have been using this type of storage for more than 40 years and misplaced files and getting damaged by floods is not a new experience to the company. This type of storage also makes it hard for them when it comes to looking for a specific document. Unlike physical storage, the Virtual or Cloud storage that will be implemented together with the ERP software has a search function and does not take up physical space and is also protected against force majeure or natural events that are a threat to physical storages and documents.

Purchasing Reports

MODEL Auto and Equipment Supplies currently utilizes only 1 purchasing report which is the record of all of their purchases. On the other hand, the future state of the purchasing processes with ERP software implementation generates various reports which significance for MODEL has been discussed for each. These would enable MODEL to eliminate repetitive tasks such as recording on columnar books as they can now just record the purchases’ data in the software and generate the report or print it out if a physical copy is needed. These reports would not just improve the purchasing department but the whole decision-making of the company as well.

V. CONCLUSION

In this case study, it was evident that through the implementation of an ERP Software Solution, the purchasing processes of MODEL AUTO AND EQUIPMENT SUPPLIES can be improved. Proven by the automatic generation of various significant reports by the ERP Software that enables MODEL to monitor their purchasing habits and evaluate their suppliers as well as an additional insight for decision making. This feature of the ERP software will eliminate repetitive tasks, MODEL can now record all of the purchases in the system and generate or print out a report when a physical copy is needed. Together with the simulation outcomes presented by the flow process charts. The Purchasing Item/Materials process’s VS ratio rose by 37.738%, from 57.500% to 95.238%, and in the Request for Quotation (RFQ) Document Creation process the VS ratio is expected to rise by 8.967%, from 34.783% to 43.750%. Lead time for Purchasing Item/Materials process was reduced by 19 minutes while 7 minutes was reduced from the Request for Quotation (RFQ) Document Creation process. The physical storage will be replaced by virtual or cloud storage that will eliminate the risks and dilemmas that the current physical storage of MODEL is facing. There is still room for improvement for MODEL Auto and Equipment Supplies with the implementation of an ERP Software such as the consignment process that could reduce their inventory costs also not just in purchasing processes but to other processes as well.

REFERENCES

Fine, C. H., Chen, Y., Shum, S., et al. (n.d.). Dynamic Process Improvement. Retrieved from:

- <https://pubsonline.informs.org/doi/abs/10.1287/opre.37.4.580>
- Ganesh, K. (2014). *ERP as a Business Enabler*. SpringerLink. Retrieved from:
https://link.springer.com/chapter/10.1007/978-3-319-05927-3_1?error=cookies_not_supported&code=691dd60a-f45d-4ff6-9947-bf670a49e523
- Allen, D. P., & Nafius, R. (n.d.). *Dreaming and doing: Reengineering GTE telephone operations* | *Emerald Insight*. Retrieved from: <https://www.emerald.com/insight/content/doi/10.1108/eb054409/full/html>
- Schmitt, A., & Hörner, S. (2021). Systematic literature review – improving business processes by implementing agile. *Business Process Management Journal, ahead-of*(ahead-of-print). Retrieved from: <https://doi.org/10.1108/bpmj-10-2019-0422>
- Sunarya, P. A., Nawi, M. N. M., & Rahayu, S. (2017). Analyze and Record a series of Purchase Transactions on Companies using Online Accounting Software. *Artist Transactions on Management (ATM), 1*(1), 38–43. Retrieved from: <https://doi.org/10.33050/atm.v1i1.654>

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Grace Lorraine Intal is a full-time faculty member in Mapua University. She is teaching Information Systems core courses in the School of Information Technology and Information Systems course in the School of Industrial Engineering. She obtained a BS degree in Management and Industrial Engineering from Mapua University, Master's in Business Administration from Pamantasan ng Lungsod ng Maynila and Master's in Information Systems from Asia Pacific College respectively. At present, she is pursuing a Doctorate degree in Information Technology at the University of the Cordilleras. She is also an independent Management Consultant.