Automated Management System for Document Approval and Cloud Record Keeping

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Abstract *— In a place where a consumable product is developed certain levels of health and safety parameters must be present to ensure the quality level of the product that is later sold to the consumer. Starting at the receiving stage there is a process to ensure that the materials and ingredients received from the suppliers meet the required health and safety standards that were previously agreed. Before being used in production the materials and ingredients are inspected and the Certificate of Analysis relevant to the delivery is evaluated and approved. But this process can on occasion have delays because of the need for input from various individuals and the need to travel from one point of the facility to another for the task to be completed. With the implementation of programs like Microsoft Lists and Power Automate a workflow can be developed and integrated into the process in such a way that the need of constant travel and the idle time related can all be made unnecessary. A Microsoft List and Workflow were step up to work in unison with each other, so that the actions required would solve themselves without the need of additional input other than the initial submission. As a result, this would help improve efficiency and help hasten the completion of the process.*

Key Terms *— Automation, Certificate of Analysis, Food Safety, Record Keeping, Workflow.*

INTRODUCTION

In the food production industry, there needs to be certain procedures that help ensure the materials and ingredients used in production meet the required quality standards of food and safety. When a product is sold to a consumer the expectation is that the product will not cause any type of harm after consumption, thus the need for parameters that control quality and food safety levels. All organizations that develop and sell a product must care for the image and consumer opinion of their brand. The consumer's opinion will always matter and mostly determines the brand can succeed. Organizations like OSHA, FDA and ISO all evaluate different aspects of the operation at PET Plastics LLC to ensure that the operation maintains a certain standard level. Thus, processes are developed and put in place which helps to provide a clear view of the way the activities are required to be executed to ensure that all the parameters of quality are followed. With procedures in places the documentation can be saved and filed with which the organization can demonstrate that the quality and food safety standards are met before that materials and ingredients are used in production.

LITERATURE REVIEW

The primary subjects of this project are workflows, automation and record keeping. But how do they relate and in what way can they be improved upon when the three are brought together? Workflows and record keeping are not things that are brought about due to modernization, they have always been part of the business sector's operations. In the case of workflows, they have helped to record in what way an organization desires an activity to be done and to help maintain the standards set forth the operation itself. A regular workflow can help state when, why, how and who does a particular activity, like in form AL-P-CS-7001 where the complete material receiving process for PET Plastics is detailed.

Record keeping has been used as evidence that organizations can use to ensure that a given activity has been completed. In the past, record keeping has

been done with hard copies of documents, primarily after all the fields have been completed and the document(s) have been verified to be correct. The approval of the records is essential in any given activity, as they certify that a leader acknowledges that the activity was done correctly. With the help of digitalization both subjects have seen dramatic changes in recent years, with the help of automation some tasks like these can be done and recorded in a more efficient manner.

Automation can help update how workflows and record keeping are utilized in any given endeavor. Automation can provide a more direct route to completing the tasks stated in a workflow. Idle times can be reduced, and personnel efficiencies can be increased by simply developing an automated workflow that can be programmed to commence once the command has been given. The automated workflow will continue to operate continuously until the objective has been completed [1].

To understand the benefits of a modernized form of document approval and record keeping, it is important to understand some of the characteristics and executions that such a tool can provide. A tool like this can provide a quicker process upon which the flow of signature gathering is optimized and waiting times can usually be reduced. In addition, there is an organizational factor that must be considered, the filing system would become digital and easier to secure and maintain organized. Most companies that currently use a system such as this one are mostly focused on keeping track of legal documents, such as, FDA, OSHA, and ISO, which are normally required by government agencies [2].

A similar project was done at a financial company in Ica, Peru that implemented a management system like the one that we are looking to develop during the project, as a result it helped increase to productivity and reducing documentation errors to just under 12%. The importance of automation is based precisely on the reduction of time and repeatable actions, but the improvement of overall efficiency. Programs like DocuSign, Microsoft Power Automate and Nintex are programs available to help create document life cycles that can automate processes [3]. For this project, a program that can help not only to automate the process but can also provide easy filing and organizing spaces for documents that have completed the cycle is also required.

This project can also be attributed to modernization since most modern-day organizations work to have their documents in digital form for easy access [4]. Modernization and automation are two factors that help organizations to maintain competitiveness in the twenty-first century. The benefits of automation can be presented in several ways, but in the case of the project the main benefit that automation would have on the organization PET Plastics is looked upon in the financial and environmental aspects. A management system for approval and filing can help reduce the amount of paper and electricity output of an organization which can become financial gains for the organization.

PROBLEM STATEMENT

At PET Plastics located in Cidra, PR has been mentioned by the managerial team and the auditors which visited the facilities the benefits of having an automated cloud-based system for all document handling and approval. A project such as this could help the organization take its next set into this modernized era of technology and help by reducing the time required by managers and team members to on document approval. In addition, it can help the organization in reducing its paper trail and keeping documents in a digital library. With managerial authorization, this could reduce the time needed when the document is solicited by an internal or external entity.

Per the companies' current process for receiving and storage for materials AL-P-CS-7001, most materials used in the water line production require that the Certificate of Quality (COQ) or Certificate of Analysis (COA) be validated by the company's Quality department upon arrival and before used in production. Currently the process is done strictly with hard copies of the documents, where they are physically delivered, approved, and later achieved

with the rest of the documents related to the delivery. In our modern digital society, we are experiencing a new age of Automation, and with the help of modern technologies we can implement new ways to make the process of document approval faster and more efficient.

RESEARCH DESCRIPTION

We currently live in the era of digitalization, the need to have hard copies of documents is beginning to be considered less efficient, cloud storage can help maintain a more organized record for longer periods of time and reduce the need to print. Having documents in a digital format and stored in a cloud file will not only reduce the company's carbon footprint by limiting the need for paper, but a filing standard can be implemented that provides an easier organization system in which anyone can find a document within the cloud library. This research will focus on ways that automation and cloud-based workflows can help develop a new way for the process of document approval to be executed.

All types of organizations use some kind of workflow that details how the operational everyday tasks are executed. This helps the operator to know in what way something needs to be done to be completed. With the help of automation, the standardization of these tasks can be implemented. In the case of the project, automation will help reduce the time needed to have a COQ or COA approved. We will be able to see the benefits of digitalization and how it can help maintain an area more effectively organized. In addition, the need to travel from one point in the facility to another can be reduced by implementing an electronic signature program. This can provide an accepted approval method, without the need to deliver or retrieving hard copies from an individual.

RESEARCH OBJECTIVES

This project can be implemented to accomplish various objectives, some of the main goals are digital record keeping, improving the document approval chain and reduction in the use of paper (reduce carbon footprint). The digital record keeping can help the Supply Chain department keep better organized all documents of arriving materials, this can also help reduce the effort of executing a search of all documents related to a specified delivery. A system upon which documents are digitally approved can reduce the need to move between departments for signatures and still provide date stamps of approval from the required managers [5].

During the project, a Microsoft List will be developed along with an automated workflow that will drive the document approval process in a quicker and more efficient way. The automated workflow will provide a set of objectives that will be assigned and digitally be completed for the approval process of delivered materials to be completed [6]. Using a well-known program a system that facilitates both the process of approval for the COA or COQ and the record keeping of already approved documents will be developed. The program will be set to be as user friendly as possible, and to reduce the possibility of errors. We want the current process (AL-P-CS-7001) to be fulfilled in its entirety and in a more efficient manner with the help of the automated workflow.

RESEARCH CONTRIBUTIONS

Upon completing this research, there will be a better understanding of the project requirements and what tools are available and are also better suited to help achieve the project objectives. This research will also provide a deeper understanding of the benefits and limitations that may be found through the project. Data can be utilized from other sources that have already implemented cloud systems like these, to see what are the best tools that help achieve the set objectives. With the help of the automated workflow, we will keep a digital record of the raw materials that are received at PET Plastics, the organization's personnel will be able to sort the entries as they see fit and keep an organized and improved record keeping system. The project will also eliminate the need for travelling long distances within the facilities. We will also be looking at ways

in which automation can help us improve our efficiency in other everyday tasks [7]. Finally, with the objective of implementing this project throughout the whole organization, this research can help us understand the needs of other departments and consider what will be their requirements that can be implemented from the beginning or in what other ways an automated workflow can help facilitate some tasks of the other departments.

METHODOLOGY

There are several ways to conduct research and to obtain information or results that help to achieve a proposed objective. On this project a Quantitative and Experimental (Step-by-Step) method can be optimum for the data gathering and testing for the proposed project. On the Qualitative side we can gather important data that with help validates the need for such a system that can help reduce idle time. In some cases, due to the workload of the person tasked with obtaining the manager's signature the document could be incomplete or unsubmitted for days while the signature is obtained. For more urgent matters an email can be used to obtain a signature, but this is not the case for a day-to-day that is not a hindrance to the operation.

In the food and beverage industry there are various processes in place to ensure that the operation is done adequately. The nature of the products developed requires certain steps to be followed and authorization signatures must be collected, and due to the current layout of the organization, far distances must be traveled for the collection of managerial signatures. Thus, this project can help expedite the approval of certain day-to-day documentation without the need to travel to the other departments in search of a signature. In addition, the system can also be a record keeper where the documents can be stored for easier access with the required approval if they are needed.

An experimental approach can also be utilized in this project; it is a testing base once the system's development has started distinctive features can be tested to see the application of the added tools and the execution of potential tasks that may be undertaken with the system. Testers can utilize the system on quick trials like scenarios that can help better understand the tools available that can help with various given tasks.

The Lean Six-Sigma tool known as DMAIC methodology can help facilitate project design and include the continuous improvement aspects of a Lean Six Sigma project [8]. The DMAIC methodology divides into five (5) phases:

- Define –the main problem and the needs are identified.
- Measure – data on the problem is gathered and the causes of the problem are identified.
- Analyze – the data of the problem is evaluated to understand what viable solutions there could be.
- Improve – viable solutions will be identified and chosen based on which can provide the better end results.
- Control – the proposed solution is implemented, and the testes begin to see the execution in hands of the uses, provides the opportunity to fix any problems that may present itself before full integration.

The research portion of the project would help define and measure certain aspects of the project. As a result, the "define" and "measure" phases have as thus far helped with the evaluation of different software tools that can be used to develop the system and bring with it the possibility of automation. With automation the process can be developed to run automatically, with the completion of a certain task in a specified area the submission would set off a chain of processes that would continuously work its way through the setup phases set by the designer or administrator.

This Six-Sigma methodology follows an idea of continuous improvement in whatever process its integrated, which can help perfect the system to a point with which all the organization can use it on their tasks and reduce idle time in their processes. Thus far the define and measure phases in DMAIC have helped identify what type of program would be

the most beneficial to use in the development of new systems. Programs like Power Automate, DocuSign and Nintex provide useful tools that can be adapted to a Microsoft platform so everyone in the organization can have easy access. These programs are also some of the most used by other organizations that have a similar desire to implement these types of Management Systems for daily use [9]. The most popular amount of them is Power Automate since it is the one that most easily can be adapted into a Microsoft platform.

Do to the natural of this project more research on programs is required. But the nature of DMAIC provides use with an "analyze" phase where the options with be evaluated and the best program or programs will be chosen (based on their adaptability on each other). We the hope of this system is that it can be easily integrated and accessed by the users, on top of the main objective of reducing the idle time during with a document must go through during the approval/validation process.

This project will require a platform that will be user-friendly and provide quick-easy access to the system. Each platform has different things that they personally offer the developer and the user. For example, DocuSign will offer the developer the opportunity to build the management system from scratch, providing control to the documents that are used, the processes and cycles that are to be used for the project and the aesthetic of how the project will appear. Secondly, Microsoft Power Automate provides some default templates and processes that the developer can use to create the management system and document life cycle, which Microsoft produced as a tool the implementation of other tools can be easily applied later the project. And Nintex is a particularly new organization which is like DocuSign in the sense that it gives the developer free reigns of most of the elements of the management system, but Nintex has the benefit of being able to be easily linked with Microsoft accounts.

Most companies currently will opt to use either DocuSign or Microsoft Power Automate which are the most well-known and have lengthy track records in workflow technology.

In the case of this project, the combination of two of Microsoft's programs will be utilized. The first being a Microsoft List where all the receiving entries will be registered as they arrive at PET Plastics. With the help of Power Automate and the workflows section include an automated workflow that reacts to the List's entries as they appear will be created which will be programmed with specific command of what actions to do when each step of the process is completed. The end objective is to have to List entry include all the information required for the documentation of the arriving material to be approved. The approval request will arrive via email and all parties involved can have access to the documents during and most importantly after the process of approval has been completed.

RESULTS DISCUSSION

This chapter will explain with greater depth the purpose of this project and the various phases required to complete the intended objective. The methodology utilized to identify each stage of the project will be the Six Sigma tool known as DMAIC (Define, Measure, Analyze, Improve, Control) [8].

Define

At PET Plastics there is a current procedure in place that establishes what are the steps required for registration of arriving materials to be processed correctly. The current procedure requires for the Certificate of Analysis (COA) of materials that are categorized are critical or ingredients to be inspected and approved by the Quality department to the utilized, for which a signature is required. The personnel from the Supply Chain Department receive the materials and oversee storing them. Thus, a person is assigned to deliver the relevant documents to the Quality Manager (QM) designated with approving the documents. On occasion, approval can be obtained instantly, if the QM is available. But if QM is not available the documents are left in their office for when they get the opportunity to approve them. This would mean that the designated person from the Supply Chain

Department would need to travel continuously to the Quality Department to verify if the COA has been verified and approved.

This can be seen as a waste of movement and time management, particularly if someone has other tasks to accomplish besides the one required to complete the receiving process. The process cannot be completed or registered in the organization's Enterprise Resource Planning (ERP) until all documents have been approved. For this project we would like to adhere to the process stated in document AL-P-CS-7001 for receiving and storage of materials. Also, to eliminate the need for the personnel of the Supply Chain Department to travel to other departments to achieve the objective of getting approval on a particular document. Finally, to help reduce the time that for the COA of a delivery to be verified and approved by PET Plastics' quality team.

Measure

In the Measure phase of the project, we will recover data, either qualitative or quantitative related to the process that we are evaluating which will later help to determine a finite solution. The previously established process by PET Plastics LLC will help us understand what are the key requirements that are needed to complete the objective of receiving critical material or ingredients used in the production process. For this we can start with a Process Map, which is used to identify each step involved in the process and can provide alternatives that entail the next required action from start to finish.

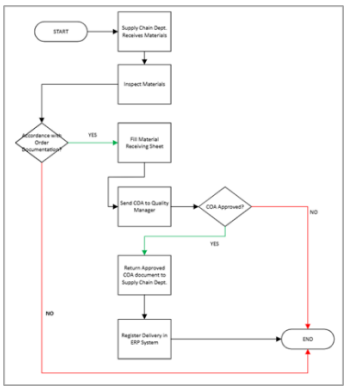


Figure 1
Process Map for the Receiving of Materials

In the Process Map each of the main activities in the process are identified, and we of these activities are the ones that can affect the process the most. For example, when inspecting the order after delivery and the verification of the COA can affect the process. If all is in order, the process can proceed to the next step, but this also means that if any type of non-conformity is detected during the forementioned activities this can result in the end of the process before it has been fully completed. The critical nature of the food service raw materials requires that all materials and ingredients be in optimal condition for them to be used.

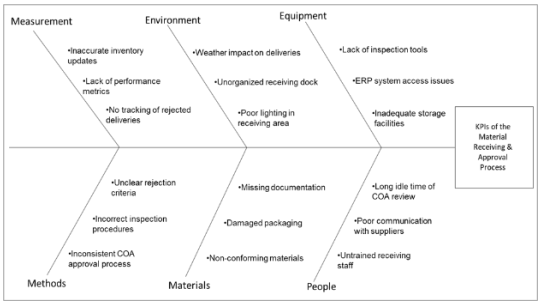
Table 1
SIPOC for the Receiving of Materials

Suppliers (S)	Inputs (I)	Process (P)	Outputs (O)	Customers (C)
External suppliers / vendors	Materials (raw materials, ingredients)	1. Receive materials	Approved materials available for production/storage	Production Department
Logistics/transportation companies	Supplier documentation (purchase order, delivery note)	2. Inspect packaging and materials	Rejected materials returned/not accepted	Quality Department
Quality Manager (for COA approval)	Certificate of Analysis (COA)	3. Verify documentation against purchase order – if not correct → notify supervisor, reject delivery, end process	Recorded and approved COA in ERP system	Logistics Department
	ERP system access	4. Send COA to Quality Manager for approval – if not approved → notify supervisor, reject delivery, end process	Updated inventory records	Procurement Department
		5. Return approved COA to Supply Chain Dept		
		6. Register order in ERP system with approved documentation		

With a SIPOC Map we can better understand how the receiving process takes place, what are the key indicators that run the process and who is affected by the process' completion. The SIPOC Map is divided into five categories: Supplier (who at the entities that add value to each step), Inputs (what is required to complete to process), Process (how the process is completed), Output (what is gained from a completed process), Customer (who is affected by the process). Each category has its own purpose and helps visualize what adds value to the process and with a deeper evaluation it can even help to identify how it could influence other processes or procedures involved in the organization. Both previously mentioned diagrams and analysis can be categorized are qualitative as there do not provide numerical figures from whom measurements can be obtained but does add value by providing a view of what areas influence the process and a starting point from which to develop a solution to the problem mentioned in the "Define" section.

Table 2

Fishbone KPIs for the Receiving of Materials



A fishbone diagram, also as an Ishikawa diagram, is a tool that can help understand what are the main reasons that may be affecting a determined topic of interest. For this project, the topic of the fishbone diagrams is the Key Performance Indicators (KPI) is the received process. The fishbone can be divided into various groups that will be determined by the investigator and the type of the topic of the research/project. After determining the topics in a fishbone diagram more specific indicators can be listed in each branch that relate to the problem and the topic of the branch. A fishbone diagram can also be considered a qualitative measure but if expanded upon, it can also provide quantitative measurements with numerical values that can later be used to develop charts and graphs. In this fishbone we can see that some of the topics of the KPIs are related or are the same decision points found on the Process Map.

Analyze

The middle phase of the DMAIC methodology is "Analyze" where the data recollected in the previous stage is gathered and the top KPIs are identified as opportunities form with to achieve a solution to the problem. Some KPIs like long idle time of COA reviews, ERP system access issues, missing documents, and damaged packaging are all part of the Process Map, which means that are some of the critical path activities that need to be completed for the next step to start. For the analysis of the current process we can identify the non-conforming and damaged packaging as the initial KPIs that can deter the process from being completed, but these KPIs are mainly influenced by outside factors that come into the process via a source external to the organization. Not to say that become the KPIs are based on external inputs they cannot be addressed as opportunities of improvement for the process.

In the case of internal inputs, the time required to get a COA of a delivery validated and approved can vary depending on different factors and since these actions are currently completed via the use of physical hard-copy documentation it can even add additional tasks to individuals involved in the process. If the approving manager is not present at that the documentation is sent for approval the process is halted, because the process states that the materials or ingredients cannot be used until approval is received. Additionally, there is also the possibility that the materials received do not meet the required specifications previously agreed upon by the organization (the client) and the supplier.

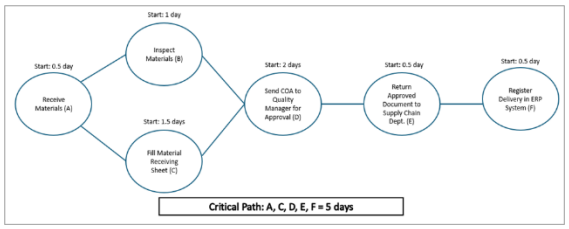


Figure 2

Critical Path for the Receiving of Materials

Based on the time required to complete the process having the COA approved is part of the Critical Path, which means that no further action can be taken until this has been done or any other stage named in the Critical Path. The approval process by being an internal input can be improved with some changes to the procedure of receiving materials.

Improve

In the "Improve" phase of the project, after analyzing what are some of the opportunities present for the process we will devise a solution to the problem. Firstly, the problem we face is the time that verifying and approving the COA can take, and this is currently done in physical hard-copy format. With modern technologies we can have this part of the process digitalized for easier interaction. The initial option was simple; the Supply Chain department can

simply send to COA in pdf format via email and the approver could digitally sign and send the document with the approval. But were the Quality manager being out of office the document would be left on their email's inbox waiting which would also halt the process. So, the objective would be to have an approval process that could automatically send notification to the email and from which approval could be given.

With the help of an automated workflow that is involved in the process this could be done. The workflow would be created using technology already available to the organization, with Microsoft List and Power Automate Workflow. In the List, an entry for the delivery can be created where the details and relevant documentation would be attached, and available for later revision. This would also work as a bookkeeping system where all the entries can be stored for easy access to the individuals that may require them. Additionally, with the integration of the automated workflow using Power Automate the workflow initiates a preset cycle once the entry of the delivery was created.

With the workflow the entry from the List would be sent to the Quality Manager or any other approver via email. The email would provide a link to the entry and all the relevant information, but most importantly the approval could be done with the click of a button included in the email. The workflow can also provide a time stamp and the approver digital signature. Since the approval request and the approved documentation would be sent and received via email, the need to travel from one point of the facility to another for that purpose would be reduced. Directly at the List entry the relevant information can to the delivery can the accessed and stored, which will include the digital approval as an indicator that materials received meet to necessary specifications.

Figure 3
Microsoft List for COA Approvals

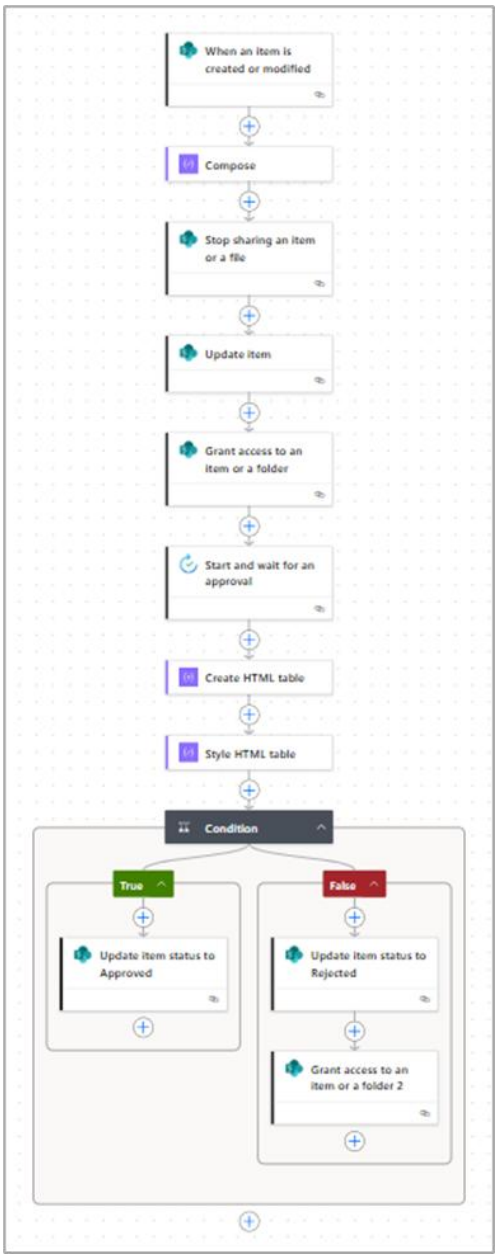


Figure 4
Automated Workflow for COA Approvals

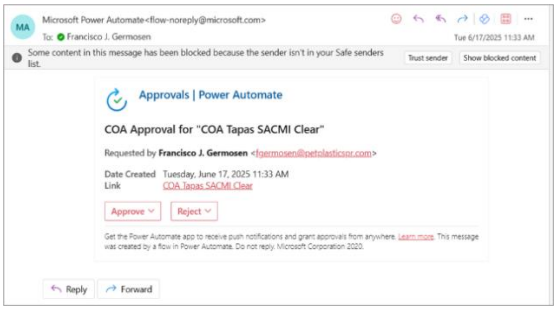


Figure 5
Email Received for Approval

Control

The last phase of the DMAIC methodology is "Control" where the developed solution is implemented and results evaluated to determine if the solution is viable for the organization. Certain parameters of control are set to be in place for this new improved activity in the process. First, the Microsoft List upon which the entries are made can only be accessed via SharePoint to which only the Supply Chain Department and Quality Department have access. Secondly, the entries themselves are set so that while "under review" or "approved" cannot be edited in anyway except by the List owners. Thirdly, the approved strategy has been set in the workflow so only the approvers listed will be able to approve or reject a new entry. The List will also provide a status update on the entry if an entry has not yet been approved the status will ready "under review" and "approver" or "rejected" depending to the decision. Lastly, a second approver was added, which will help increase the speed with which a decision on the approval of any given COA.

Conclusion

This project was designed to help improve a previously created procedure and reduce the amount of time that it would take to complete the procedure. With the integration of modern technologies into the work environment the team can now let the workflow complete the process ones the initial entry has been submitted. The use of new programs such as Power Apps, Power Automate, and Artificial Intelligence (like Copilot & ChatGPT) can help an organization lighten their workload and focus on more important activities that require more detailed inputs for them to provide value to the organization or a process [10]. The use of Automated programs can be a challenge to develop, due to the level of specification needed and the fact that as something that is relatively new, the individuals that will be tasked with the day-to-day us of these new tools will need to the training accordingly. As more departments integrate the use of automation and artificial intelligence technologies in their daily tasks the more like will be that set objectives can be met faster and with a higher level of efficiency.

References

[1] E. De Jong, B. Lalla-Sewgoolam and G. Vainberg, *Unlocking the full power of automation in industrials*, McKingsey & Company, 2019.

[2] V. Giménez Chornet, "Normas ISO para la gestión de los documentos electrónicos: buenas prácticas para la gestión documental en las empresas," en *Revista de la Biblioteca y Archivo Histórico de la Asamblea Legislativa Plurinacional*, vol. 9, no. 40, pp. 7-16, 2015.

[3] A. Guilmette, *Workflow Automation with Microsoft Power Automate: Use business process automation to achieve digital transformation with minimal code* (2nd Ed.), Birmingham, UK: Packt Publishing, 2022.

[4] M. Dotoli, A. Fay, M. Miśkowicz and C. Seatzu, "An overview of current technologies and emerging trends in factory automation," in *International Journal of Production Research*, pp. 5047-5067, 2018.

[5] L. Guzmán and R. Lafuente, "Gestión Documental Electrónica: Retos y desafíos para un nuevo aprendizaje," en *Cuaderno Archivístico*, pp. 10, pp. 12-98, 2018.

[6] C. Plesums, "Introduction to Workflow," in *Workflow Handbook*, 2002.

[7] A. Fang, V. Chen and M. McDonald, "Breaking down the impact of automation in manufacturing," in *MIT Science Policy Review*, vol. 4, pp. 127, 2023.

[8] J. A. A. Hanoosh and T. O. Kowang, "The fundamental concept of integrates lean six sigma and dmadv methodologies," in *International Journal of Academic Research in Business and Social Sciences*, vol. 13, no. 10, pp. 1027-1040, 2023.

[9] J. Frohm, V. Lindström, M. Winroth and J. Stahre, "The industry's view on automation in manufacturing," in *IFAC Proceedings Volumes*, vol. 39, no. 4, pp. 453-458, 2006.

[10] D. Mathew, N. C. Brintha and J. W. Jappes, “Artificial intelligence powered automation for industry 4.0, in *In New Horizons for Industry 4.0 in Modern Business*, pp. 1-28, 2023.