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Robotic Process Automation as an enabler of Industry 4.0 to eliminate the eighth waste: a study on better usage of human talent

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Abstract

Nowadays, with increasing globalization, companies have to be prepared to adapt and respond to the challenges raised by the 4th Industrial Revolution. The adoption of new technologies has been the most used solution, creating new challenges concerning worker-machine interaction. The required skills of workers tend to change, as do their tasks, which, many times, do not add value, contribute to talent waste, the eighth waste of Lean, and generate dissatisfaction. This paper reviews how this problem can be eliminated, by implementing Robotic Process Automation in a company that provides residential hot water solutions. This technology automates repetitive processes. The results obtained show that, through Robotic Process Automation, it is possible to automate the tasks that do not add value and contribute to eighth lean waste.

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Keywords: Industry 4.0; Robotic Process Automation; 8th waste of Lean; Human Talent

1. Introduction

With the intensification of globalization, competition between manufacturers has increased, with constant pressure for organizations to reach an ever-higher level of performance In this way and to stay in the market, organizations have to face changes in their work processes, often going through process standardization and waste elimination [1].

On the other hand, digital technologies have been occupying an important position, helping to achieve business

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goals, namely regarding process standardization and increased resource efficiency [2]. For this reason, companies have been increasingly introducing technologies into their daily life. This introduction causes "new forms of interactions between humans and machines, and are therefore directly affecting workers and the nature of their work" [3]. The necessary skills for a good performance of the workers are changing, as well as the tasks to be performed by them. For example, one of the biggest challenges of Industry 4.0 is the massive amount of data generated by technologies [4].

Lean is a business strategy widely accepted and recognized due to its significant success in increasing the company's effectiveness. This is achieved through continuous improvement and waste identification and elimination [5,6]. Waste of human talent is considered the eighth waste of Lean, one of the most difficult to eliminate [7].

Technology is evolving more and more, and the adoption of new technological solutions grows day by day in organizations. Worker evolution, in turn, cannot keep up with the technological evolution of the market, creating a mismatch between jobs and employees. The human factor is one of the most challenging and crucial parts of digital transformation [8] and therefore human capital cannot be neglected during digital transformation.

In organizations, it is vital to support the worker to develop the skills needed for Industry 4.0 and to reduce, as much as possible, the gap between jobs and employees. Consequently, it is necessary to free the worker from tasks that do not add value and generate waste, as well as activities that do not stimulate the intellect of the workers. The solution to these issues lies in the automation of routine tasks, and Robotic Process Automation (RPA) can make a great contribution in this domain. RPA is a technology that allows the automation of time-consuming, rule-based, and repetitive tasks such as data processing.

In response to the need already presented, this paper aims to conduct a study to implement an RPA to automate non-value-adding tasks and therefore reduce the eighth Lean waste in a water heater manufacturing company.

The paper is organized as follows. In section 2, a theoretical framework of the concepts that will be addressed in the practical case is presented (eighth waste of Lean and RPA). In section 3, the methodology of the case study is presented as well as its results. In section 4 the main conclusions and limitations are presented.

2. Theoretical Background

2.1 The eighth waste of Lean: Non-Utilized Talent

Originating in Japan, Lean is a business strategy widely accepted and recognized due to its significant success [5,6]. Besides increasing the company's effectiveness, it improves service and quality, reduces time and total costs [5]. This is achieved through continuous improvement and waste identification and elimination [5,6]. Waste is any process that does not add value to the customer. The first seven wastes of Lean identified in the literature are defects, overproduction, waiting time, transportation, inventory, motion of people or materials, and extra processing. However, none of these include the waste associated with the most important factor in companies, i.e., the talent [9]. To include the human factor, the eighth waste of Lean was introduced, defined as Non-Utilized Talent waste.

Non-Utilized Talent waste refers to the underutilization of people's talent, knowledge, skills, and abilities [9]. According to the English dictionary, Knowledge is the theoretical or practical understanding of something, e.g., the English language. Ability is the quality of being able to do something, e.g., verbal abilities. Skills can be developed through training or experience that allows the employee to work with given knowledge, e.g., speaking [10]. Talent is like a natural skill since it has already been born with the worker and can be improved with time. If an employee has a "greater level of education, experience, or skill required" for his job, it is considered talent waste [9]. Analyzing the fit between employee-job is a crucial aspect for avoiding the eighth waste of Lean. The management of an organization must have the ability to assign tasks to its workers that add value to both the company and the employee itself.

2.2 Robotic Process Automation

RPA is an emerging workflow process automation solution, like data processing [2,11]. This technology is one of the Industry 4.0 significant trends [12], and it is already implemented in many areas, such as accounting, finance, insurance, human resources, banking, and logistics [2]. It emerged as an improvement of simple macros, turning them into cross-functional and cross-application macros [13], which allows the user to interact with more than one system

and include decision variables [14]. RPA can be defined as a technology that enables the automation of repetitive tasks through robots, generated by software tools, capable of executing "sequences of fine-grained interactions with Web and desktop applications", imitating human behavior [15,16]. Automation Anywhere, Alteryx, UiPath, or BluePrism are some examples of tools to create these robots [14], also known as "bots", and implement this digitalization technology.

Just as robots replaced humans in physical work on the shop floor, RPA or bots allow the office worker replacement in repetitive, non-value-added, and time-consuming intellectual tasks [2,17]. It can do tasks like typing, extracting, moving, or copy-pasting vast amounts of data from one system to another, opening files, sending emails, among others. They recognize and read fields on a screen of application software, modify the content if necessary and introduce it into other fields of the same or different software [18]. Bots do not have a physical representation and "can be thought of as digital worker, using its computer station, username, and password similar to a human employee" [14].

RPA is much easier, faster, and less expensive to implement than traditional technologies, not requiring advanced programming skills [19]. It focuses more on individual tasks and not on an entire business process. The efficiency of the RPA can be quantified through the number of human working hours saved with bots' implementation [20].

RPA implementation can bring many benefits for companies such as improving the company's efficiency. Bots can work 24 hours, seven days a week [21], improving the organization's productivity by 86% [13]. Unlike humans, they are less likely to make mistakes, increasing the quality and accuracy of results, allowing better data analysis [1,19]. It improves the organization's competitiveness [1], speeds up digitalization [21], and positively impacts the worker. There are employees responsible for rule-based, repetitive tasks in every company, e.g., data processing. These tasks generate Non-Utilized Talent waste and, in the long run, can become exhausting and consequently unsatisfactory for the worker. Less pleasant tasks start being performed by bots, freeing up workers for other added-value activities and consequently promoting a higher level of satisfaction. RPA may be one opportunity for organizations that value their workers and want them to use their knowledge in the best way possible. According to a study made by Deloitte [13], well implemented, it is a technology that effectively can allow better usage of human talent. With the support of the robot, the worker can focus on high-value-added tasks [1,19] and, also, focus on gaining new knowledge, improving skills, and stimulating creativity [1,21]. RPA can be useful for companies whose work is increasing but do not have the financial capacity to increase their headcount [14] since a bot is cheaper than an employee. In summary, a wide range of benefits can be found with the implementation of RPA, more specifically: (i) RPA implementation benefits; (ii) working 24/7 fewer errors; (iii) quality and accuracy in results; (iv) data analysis improvement; (v) productivity improvement competitiveness improvement (vi) faster and cheaper than other technologies implementation; (vii) full-time equivalent savings; (viii) better usage of human talent; (ix) customer service improvement; (x) Worker satisfaction improvement; and (xi) Improve Employees Retention.

3. Practical Case: Robotic Process Automation implementation

In this study, RPA is implemented, in an organization that provides residential hot water solutions, in order to analyze its contribution for a better use of human talent. The automation of repetitive processes is done through a bot created using the Automation Anywhere tool [14].

3.1 Methodology

A methodology to conduct the study that culminated in the implementation of RPA was created and the main phases are presented in figure 1.

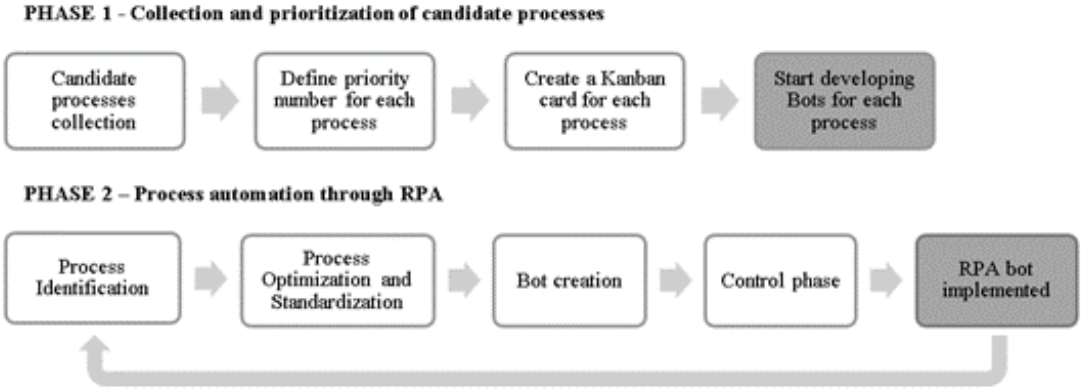

Fig. 1. Robotic Process Automation Implementation Methodology

The RPA implementation project is a new approach in the company, so Phase 1 is to identify the first processes to be automated, according to their priority. It begins with collecting some processes that may be suitable for RPA in each department. Then, use a tool to assign the priority number to each process regarding its suitability for RPA. The processes with the highest priority will be the first to be automated. The third step in this phase consists of creating a card per process on a Kanban board. Kanban, which means "visual card" in Japanese, is a lean tool to improve production and inventory control by making scheduling more visual [22]. According to Parsons et al. (2019), a "Kanban board visualizes the workflow by having cards progress through several columns named, for example, 'Backlog', 'Ready', 'In Process' and 'Done'". The Kanban system is to help with project management, to have a total view of the project, the status of each process, and avoid having too many processes to be automated at the same time. At the end of these three steps, the processes are ordered according to their priority.

Phase 2 occurs whenever a new process is chosen for automation. The first step is process identification. There are many criteria to identify if the process is suitable for RPA: (i) rule-based; (ii) high volume of transactions; (iii) stable and predictable; (iv) high maturity; (v) susceptible to human error; (vi) no need for human intervention; and, (vii) low need of cognitive requirements. standardized. The appropriateness of the process to be automated may influence the success of the RPA implementation [19], so it must be well chosen. The process must be composed of straightforward rules with low exceptions and have a high level of maturity, stability, and predictability [23,24]. When a process has a high volume of transactions [19,23,24], it is usually time-consuming. In this situation, automation can be an opportunity to reduce costs while decreasing the probability of error and increasing process performance [19]. Since robots lack analytical and creative skills [19], the process cannot have a high need for human intervention and cognitive requirements. Processes that include non-electronic data need to be digitized first since RPA is not prepared to read this input type. A standard format form is also needed, so RPA does not have difficulties capturing data, e.g., suppliers' invoices [21].

After identifying a suitable process for RPA, it must be optimized and standardized [2]. First, the AS-IS process must be modeled using a process-oriented notation – BPMN 2.0 –, and then it should be improved and standardized.

The next step in this study was the bot development through an RPA tool, in this case, the Automation Anywhere tool. The control phase is the next step, and the one before implementation is completed, where errors are detected and bot performance is measured [23].

3.2 Results

Process collection was done through an e-mail sent by each area manager with the processes that they considered candidates for automation through RPA. Eighty-three candidate processes were obtained. The purpose of step “Define priority number for each process” was to define an order of processes to be analyzed and automated. For this, a Figure of Merit form was created (Figure 2). The value of the Figure of Merit varies according to the process classification in each of the criteria considered in Table 1.

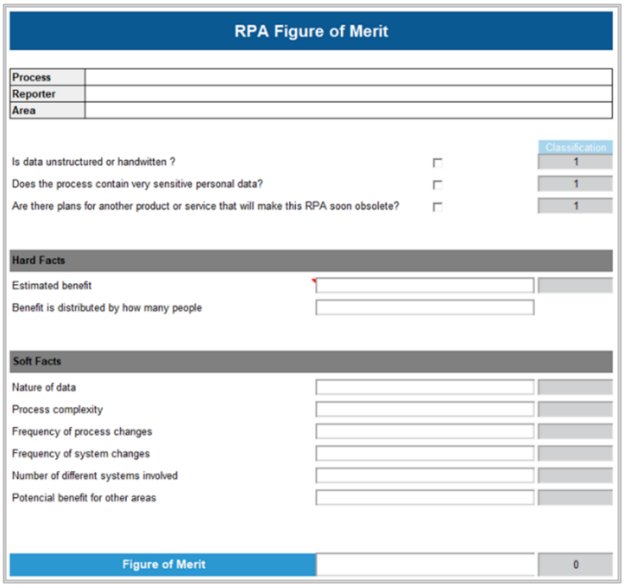

Fig. 2. Figure of Merit form for assigning automation priority to each process

The form is divided into three groups: stoppage factors, hard facts, and soft facts. The three questions present in the form intended to identify if the process has at least one stoppage factor:

- Unstructured or handwritten data: according to the literature, processes with unstructured or handwritten data have to be digitized before being automated. Therefore, it was considered that these processes would not be candidates for this initial phase of the project, as they would first need another solution.
- Very sensitive personal data: a significant concern at Bosch is the protection of its employees' data. Since it is a new technology in the company, with some security issues, it was decided to leave these processes for another phase of the project.
- RPA soon obsolete: the entire process of RPA implementation is time-consuming and requires a lot of work and costs. If the process is soon discontinued or changed, there is no benefit in automating it, and the investment amount will not be recovered.

If the process does not have a stoppage factor, the value of the Figure of Merit (1) varies according to the process classification in each of the criteria considered in Table 1.

$$Figure\ of\ Merit = Stoppage\ factors * (Hard\ facts + Soft\ facts) \quad (1)$$

For project management, there arose the need for a tool that would allow real-time control of the status of each process, both for the team and those responsible for each process. Since the implementation is time-consuming and respects the order of priority, the reporters must be able to monitor the status of their candidate processes.

Therefore, an existing tool created by Atlassian Jira began to be used. Atlassian is an Australian company that developed software such as Jira and Trello, allowing teams to work better. Jira is a software for managing and maintaining issues related to a project. The tool allows the creation of projects, and each one has an associated Kanban board and a team constituted by project administrators, developers, and reporters. For this project, the Kanban board columns are ‘Ideation’, ‘Evaluation&Design’, ‘Build’, ‘Quality Assessment’, and ‘Run’. The Kanban Board can be viewed by area or by the developer. All cards start in the ‘Ideation’ column. Depending on their implementation status, the cards representing each process can be moved from column to column. The responsible for this movement is the developer. Every time it happens, the reporter is notified by email. All cards were created and placed in ascending

order of FoM.

All information about the process is on the Kanban card, such as: Process name; Reporter; Area; Description: a short description of all process steps and systems used, e.g., Excel, SAP, email; Priority: FoM classification (Minor, Medium, or Major); Estimated benefit: Full-Time Equivalent potential reduction; Developer; and, Attachments: Figure of Merit form file and video with the current process (optional).

Table 1. Criteria used to assign the figure of merit to each process

Criteria	Points	
Estimated benefits per person	FTE < 0.05	1
	0.05 =< FTE < 0.1	2
	0.1 =< FTE <0.5	3
	FTE >= 0.5	4
Nature of data	Handwritten, Unstructured	1
	A mix of digital and handwriting	2
	Digital structured data (e.g., human handled excel)	3
	Digital standard data (e.g., template or database)	4
Process complexity	Very challenging process	1
	Moderately challenging process	2
	Relatively straightforward process	3
	Straightforward process	4
Frequency of process changes	Commonly	1
	Somewhat commonly	2
	Rarely	3
	Very rare	4
Frequency of system changes	Externally built, very uncertain	1
	Regular changes	2
	Not commonly changing	3
	Inhouse, well built, and robust	4
Number of Systems involved	10+ Systems involved	1
	7-10 Systems involved	2
	4-7 Systems involved	3
	1-3 Systems involved	4
Potential benefit for other areas	No	1
	Several	4

After all the cards were created, the automation of processes started, following the order previously established.

The purpose of the “Process Identification” step is to check whether the process is suitable for RPA or not. Since this is the beginning of the project, area managers have already made process identification in Phase 1, step “Candidate processes collection”. Although the process is expected to be suitable for RPA, the developer must always check if documentation is well filled and if the process effectively respects the criteria in Table 1. “Process Optimization and Standardization” aims to eliminate unnecessary steps and waste sources, optimize the process and then standardize it. It starts with process discovery. To better understand the process and be able to draw its current status AS-IS, three methods were used: an informal interview was done with the process responsible while he was carrying out the tasks (detailed observation of workers conducting the task). The interview was recorded (video recordings) to avoid any doubts in the future.

The AS-IS process was modeled through BPMN 2.0. An example is shown in Figure 3. After analyzing the process, some inefficiencies were identified, and ways to minimize them were found. An example is shown in Figure 4.

The inefficiency was identified since the worker needed to call a variant and manually enter the dates. SAP Variants allows assigning values to fields, such as current date, first day of the month, current date +/- days. For this reason, new variants were created, based on the previous ones, but now with automatic dates.

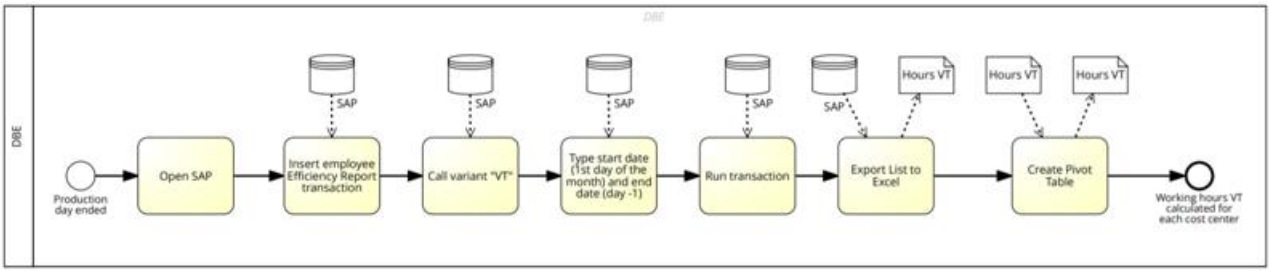

Fig. 3. AS-IS process example

Inefficiency	Solution	Savings
SAP → Call variant "VT" → SAP → Type start date (1st day of the month) and end date (day -1)	SAP → Call variant "VT BOT"	20 sec

Fig. 4. Process Inefficiencies and ways to minimize them

After the optimized and standardized process, bot development could finally begin using Automation Anywhere. Once bot code was created, and before moving it to the production environment, it was necessary to test it and fix any errors that the code might have (“Control phase”). The person responsible for the process participated in this control phase. Since this is the one who knows the process and its outputs best, he can find errors more quickly if they exist.

In the last step of Phase 2 (“Bot implementation”), the process is already optimized, standardized, and finally automated through RPA. At the end of the implementation, it is important to know the changes in the cost of carrying out the process.

Two processes were automated through RPA: a company's key performance indicator calculation process and stock analysis process. Both processes were rule-based, straightforward, without exceptions, stable, and performed daily. Process owners were asked about the difference between before and after automation. They answer that they can dedicate themselves more to data analysis after automation, doing it more thoroughly and correctly. With the same working time, employees only have to dedicate themselves to data analysis. They start to have more capacity to carry out more satisfying tasks that demand more of their knowledge, and that really adds value to the company. An increase in employee satisfaction was also visible. They were relieved that they no longer had to perform the repetitive and time-consuming tasks, which in the long term became boring and unsatisfying. The process owners felt more fulfilled, showed higher morale and increased their analysis quality. Given that the project methodology was carried out from beginning to end, it is possible to compare the reality of this implementation with what was expected from the literature. It was found that the suitability process criteria are essential. If a process does not respect them, it is most likely not suitable for automation through RPA. Trying to automate this type of process only leads to wasted time, wasted resources, and inefficiency. It is proven that the technology is efficient in automating repetitive tasks. The performance of these tasks by a human is very susceptible to errors. Its automation allows for fewer errors since the bot does the task always following the same workflow. Usually, there are no deviations from the correct sequence of steps ("fewer errors"), which leads to "quality and accuracy in results". With the same working time, employees only have to dedicate themselves to data analysis ("data analysis improvement"). They start to have more capacity to carry

out more satisfying tasks ("worker satisfaction improvement") that demand more of their knowledge ("better usage of human talent"), and that really adds value to the company, potentiating "productivity improvement".

4. Conclusions

With the constant growth of Industry 4.0, organizations have focused a lot on implementing new technologies with promising benefits for their results. Amid so much innovation, the most important part of the company– the human capital – are often forgotten. This neglect often results in a lack of skills needed for Industry 4.0. Companies must focus on their workers and prepare them for the digital transformation to keep them in their valuable companies and satisfied with their job. A possible solution to this challenge is automating tasks that do not add value and contribute to the waste of human talent, also known as Non-Utilized Talent, allowing workers to have more time to improve their skills and focus on tasks that really demand their knowledge. RPA is a technology that puts the worker at the center of innovation, freeing them from non-value-added tasks to have more time to perform tasks that demand their skills. RPA focuses on automating rule-based and repetitive tasks that not only add no value but increase worker dissatisfaction.

In this study, to analyze the technology's potential, an RPA was implemented in a company that provides residential hot water solutions. Through the use case, it is proven that the technology is effective and that the bot is able to replace the worker in tasks that do not require cognitive effort. The same was proven through the interviews made with the process owners. Based on this experience, it was possible to identify some benefits resulting from the impact of RPA in this company, starting by mentioning the data analysis improvement and full-time equivalent savings. This technology can also potentize productivity improvement, a better usage of human talent, and worker satisfaction improvement. Therefore, RPA can and should be considered a solution for the elimination of the eighth Lean waste. Step by step, processes that contribute to Non-Utilized Talent waste can be eliminated, and workers are freed up for tasks where their skills are better used.

With RPA there are no more time limitations, as the bot can run the tasks any day of the week and at any hour. For example, the company's key performance indicator calculation process had to be carried out on weekends as well. If the employee did not want to turn on the computer on the weekend, he accumulated work for Monday.

Automation Anywhere is a very intuitive tool, and it does not require advanced programming skills, so creating bots is not very complex. In addition to being easier, cheaper, and fastest to implement than other technologies, RPA allows for quick improvements, leading to full-time equivalent savings and improving employee efficiency from automation to automation.

Customer service improvement is also visible. The automation of the stock analysis process allows faster analysis with fewer errors, leading to a better production planning, according to the references that the customer ordered. The customers of the company's key performance indicator calculation process are employees from different company areas who participate in the meeting. With the automation of the process, the key performance indicator value can always be consulted from the same time, without delays.

It was possible to find similar results to the ones found by the author [11], concluding that automation of hospital routine tasks through RPA helped to reduce human labour in business processes, and the professional could “concentrate more on the interaction with the patient and thus create value for the customer”. Additionally, since the bot makes fewer errors, it helped improve the quality of the work.

The fact, in this study, only one RPA tool is used which can be considered a limitation. Other tools can allow other types of automation that Automation Anywhere does not. Therefore, in the future, it is important to continue to study the RPA tools and which ones can be useful, considering the processes to be automated.

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