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REVIEW ARTICLE

ROBOTIC PROCESS AUTOMATION: INDUSTRIAL MODEL

Robotik Süreç Otomasyonu: Endüstriyel Modeli

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ABSTRACT

We are living the fourth industrial revolution, an era where we find enormous opportunities, but also many doubts because the world of work is changing, we are increasingly finding more robots doing operational and manual work.

While many people believe automation will replace human work in the future, a McKinsey study estimates that by 2030, investment in technology could create up to 50 million jobs worldwide. In fact, automation contributes to improving the productivity of both employees and companies.

The analysis clarifies that while opportunities will come, automation will cause a considerable number of workers to be displaced and may exacerbate the employment gap between skilled and unskilled workers.

Keywords: Robotic Process Automation (RPA) , Automation, Industrial Process.

ÖZET

Dördüncü sanayi devrimini yaşıyoruz, muazzam fırsatlar bulduğumuz bir çağ, ama aynı zamanda birçok şüphe de var çünkü iş dünyası değişiyor, her seferinde operasyonel ve manuel işler yapan daha fazla robot buluyoruz.

Birçok insan, otomasyonun gelecekte insan işinin yerini alacağına inanırken, bir McKinsey araştırması, teknolojiye yapılan yatırımın 2030 yılına kadar dünya çapında 50 milyona kadar iş yaratabileceğini tahmin ediyor. Aslında otomasyon, hem çalışanların hem de şirketlerin üretkenliğini artırmaya katkıda bulunur.

Analiz, fırsatlar gelmekle birlikte, otomasyonun önemli sayıda işçinin yerinden edilmesine neden olacağını ve vasıflı ve vasıfsız işçiler arasındaki istihdam farkını artırabileceğini açıklığa kavuşturuyor.

Anahtar Kelimeler: Robotik Süreç Otomasyonu (RPA), Otomasyon, Endüstri Süreci.

1. INTRODUCTION

The era of the fourth industrial revolution has brought with it a new way of doing business through automation and data exchange, where machines and humans work together for the benefit of companies.

The technological future leads us to work hand in hand with machines, both software robots that mimic human actions and artificial intelligence (AI) systems that simulate human intelligence. RPA robots are trained to specialize in certain tasks and not complex decisions, while AI rbots can even make predictions.

Advances in robotics, artificial intelligence and machine learning are ushering in a new era of automation, where machines match or exceed human performance in a wide range of work activities, including those that require cognitive skills. This is confirmed by a study by McKinsey.

In recent years, the world has seen how little by little some of the tasks that humans do have been carried out by robots; with the benefit of increasing productivity, reducing expenses and human error. Which completely impacts the way organizations work.

People who are more immersed in the world of digital transformation and know the benefits of robotic automation, know that we must reinvent roles and increase capacities to be in teams working with robots. If we hand over the repetitive and operational tasks to the robots, we can focus on more complex tasks that require more strategy to focus more on doing business and achieving objectives.

Camilo Macías, an expert in process automation at Pragma, explains that people get bored with operational jobs because they are experiencing a change in mentality, to move on to an evolution, have more free time with their family and be able to train. "In the future, we will have such a big change that everyone will have to adapt, we will see if people support this change or not. The one that best adapts survives ", he warns.

Whoever is able to adapt will have more free time to train and innovate, to do better business and execute bigger challenges; whereas robots that do not think are made for the manual and operational.

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In the fourth industrial revolution, the application of robotics will help us in the efficiency of multiple processes in organizations and in many of the daily activities.

Every time we think of a robot, we think of industrialists and androids, but a robot is any process or object that can perform without human intervention, that is, automatically.

In this digital age, the term robotic process automation, in English, Robotic Process Automation (RPA), a set of technologies for the automation of business processes that simulates or replicates the actions of a human being by interacting with the graphical interface of user of a system.

An RPA robot is software specialized in performing repetitive activities that is executed by a human at his workstation. Therefore, you can connect to a database, using APIs or web services, make a record in a customer database to perform analytics, BI or for Big Data. This is an automation model on purely computerized processes, which improve quality, reduce costs, time and errors.

2. THE DEFINITION OF AUTHOMATIZON

This section takes a brief tour of the history of automation and what are the different definitions that exist. In order to define the concept of automation [DiFrank-2007] makes a brief historical review on indications regarding automated systems. The pioneer in the creation of automatic systems was Ktesibios of Alexandria, who lived in 300 BC. His invention consisted of a float regulator whose objective was to control the water inlet to a water clock by means of a plug valve connected to a wooden float in a tank. A drop in the water level in the tank would cause the float to fall, opening the valve to let in more water and maintain the water level in the tank. Later the ancient Egyptians attached mechanical arms to statues of the gods. The priests were in charge through divine grace to inspire movements to the machines. It was not until the seventeenth and seventeenth centuries when the first mechanical dolls emerged that have characteristics very similar to current robots. The industrial revolution produced the appearance of new mechanical creations within the field of industry. [DiFrank-2007] indicated that the greatest advance in automation of the time was the appearance of steam engines invented by James Watt.

Later, the flyball controller emerged, which was a pioneer of its time in the subject of force control. This device is made up of two metal balls mounted on two lever arms that are connected to the rotating output shaft of the motor. The metal balls rotate at very high rates, causing the centrifugal force to push them out. This movement would be transferred to the lever arms which at the same time activate the control valve. This valve prevents the flow of steam around the piston, reducing engine speed. Below you can see an explanatory outline-summary.

After briefly analyzing which have been the most important automated systems over time. We are going to delve into the different ways to define automation. As a starting point, automation can be defined as a set of techniques associated with the application of mechanical / electronic and computer-based systems, whose objective is the operation and control of production. The first definitions of automation were exposed by [Parasuraman et al -1997], this author defines automation as the reassignment of an activity performed by the human to a machine. Later [Parasuraman et al -2000] define the concept of automation more fully through three basic features.

- ✓ Automatic control of the manufacture of a product produced in a number of successive stages.
- ✓ The use of automatic control to any branch of science or its application in industry.
- ✓ The third characteristic feature is the summary of the previous two; and consists of the use of electronic or mechanical devices to replace human labor.

In recent research [DiFrank-2007] defines automation as automatic operations carried out by a device, process or system that are controlled by mechanical or electronic devices that act as the human being's organs of smell, sight.

Taking the proposed definitions of automation as a reference, there are a number of advantages and disadvantages that influence its implementation. The first investigations that expose this set of advantages are from [Dale, W-1988].

- ✓ Increased productivity and consistency in products [Stone, et al-1996]
- ✓ Automation generates stability and robustness in the system.
- ✓ Automation technologies are flawless.

- ✓ Improve staff working conditions, increasing safety
- ✓ Perform operations physically impossible for the human operator
- ✓ Improve the availability of products, being able to generate the necessary quantities at the right time.
- ✓ Integrate management and production.
- ✓ In contrast to the theories [Dale, W-1988], [Thurman, et al-1997] exposes a series of disadvantages about the implementation of automation in an industry.
- ✓ Automation is an intermediate level of intelligence, with enough power to be able to carry out activities carried out by humans. This system is not capable of interacting with all variants of the environment.
- ✓ The automation software only responds to situations previously established in the design. Automatic systems present various degrees of fragility depending on the activity they perform
- ✓ Automation is a tool encompassed within the field of productivity, which has associated costs. These costs are very important since they entail the hiring of qualified personnel who are capable of working with the new machines.
- ✓ Lack of clarity is a determining factor in advising against automation. On many occasions it is very difficult for the operator to differentiate which processes are acting correctly and which are not, and in the event of a failure how to act.
- ✓ The appearance of islands of automation. These islands consist of the union of independent and partially automated systems to act as a single system. The union of the systems is carried out by the operator.

3. TYPES OF AUTOMATION

From the definition of automation raised in the previous section, different investigations arose on the types of automation that exist. The first authors to present their results were [Nitzan, et al-1976]. For these authors there are the following types of automation.

- ✓ Fixed automation: It consists of a continuous manufacture of the same product in large quantities.
- ✓ Fixed or programmable automation: It makes the manufacture of few products in small quantities and low costs, allowing easy programming and the performance of different tasks. It is endowed with great flexibility that gives rise to a large amount of information that is handled by the computer.

Subsequently, the investigations of [Mirchandani, et al-1988] deepen the study of a new type of automation (flexible automation), starting from the theories of [Nitzan, et al-1976]. [Mirchandani, et al-1988] state that the basis of flexible automation is the flexibility of the machinery. This flexibility is conditional on a production planning. Planning consists of a sequence of decisions where several processes are involved, among which stand out: sequence of work of each machine, routine of work, etc. In recent investigations [Mandado.E-2005] expand the studies proposed by [Mirchandani, et al-1988] [Nitzan, et al-1976], defining four types of automation based on the control of the manufacturing process:

- ✓ Fixed automation. The restrictions presented by the manufacturing equipment will condition the production sequence. This type of automation has the following characteristics
  - It is made up of a simple sequence of operations o It requires a large investment due to the demand for highly specialized equipment.
  - It has high production rates
  - It does not adapt to variations in demand.
- ✓ Programmable automation. It is applied in manufacturing systems where the production equipment is designed to make changes in the sequence of operations according to the different products. It is suitable for batch manufacturing and does not allow changes to product settings. Here are a number of characteristics that complete the definition.
  - Existence of a previous period for the manufacture of the different batches. o To make batches of different products, changes are introduced in the program and in the physical arrangement of the elements.
  - A large investment is made in general application equipment such as numerical control machines.

- An example of this type of automation are PLCs (Programmable Logic Controllers) and robots.

✓ Flexible automation. It arises with the objective of correcting some of the deficiencies presented by programmable automation. It is capable of producing changes in the programs and in the existing relationship between the elements of the manufacturing system. An example of flexible automation is numerical control machines.

4. THE TECHNOLOGY OF AUTHOMATIZATION

Making reviews on the different definitions of the concept of a production process, we focus on the application of the design of the production system in the conception offered by the OTA (American Office of Technology, 1984) that makes a first approximation of the manufacturing process . From the perspective of the OTA, the entire production process begins the moment the management department decides to make a new product, based on the information available from the marketing staff. From this department the specifications of the size, shape, function and execution design are sent to the engineering department and from this department the planning for the product will be developed, taking into account the machinery and materials that are necessary.

During this process of design and planning of the product, it is necessary to take into account the decision making regarding the choice of materials to be used and the machinery. However, in production situations with fewer products there are no such choices and they reduce the complexity of the system. As a synthesis of this first phase of the production system, we confirm that its function is oriented to the design of a product model based on market needs. In the next phase proposed by the OTA, called the production phase, it focuses on the choice of the machinery necessary to produce the parts according to the processes defined in the design phase. In this production phase, it is subdivided into three sub-processes that are detailed below:

✓ Handling of the material. Each of the processes to be carried out requires precise materials that must be transferred from one area of the plant to another. For this reason, there are several workstations that will divide the processes into different sub-processes, allowing a reduction in costs and an increase in productivity. As an example, there are transport systems such as forklifts and conveyor belts.

✓ Manufacturing. In this phase the transformation of the material is carried out by means of manufacturing methods. The best known processes are extrusion, molding, turning, milling, etc. The selection of any of these methods depends on the size and shape of the part. As an example, to produce cylindrical parts the process of turning is used. In these manufacturing processes, the time of making the parts plays a very important role and depending on their complexity, the parts will be produced in a greater or lesser time, leading to greater efficiency in the production process.

✓ Finishing. Product production involves a final review phase. Manufacturing processes can produce imperfections in the part that must be eliminated and to avoid these imperfections, quality control techniques are used to increase the efficiency of the production line. Other techniques used to eliminate these imperfections are polishing the piece, repainting it, etc.

5. THE FLEXIBLE MANUFACTURING SYSTEM

As a consequence of the situation described in the previous section, companies urgently seek to produce quality and low-priced products. This situation can have a rebound effect, often causing an increase in prices and a shortage of material. The solution that arises in the manufacturing of production is the implementation of new techniques. These techniques that could improve the situation described are understood as flexible manufacturing systems. In the first research on flexible manufacturing systems, authors such as [Chen, et al-1991] defined an FMS (Flexible Manufacturing System) as a computer-controlled configuration, made up of semi-independent workstations. This technique includes a material handling system designed to efficiently manufacture more than one type of part between low and high volumes.

The aforementioned authors explain in their research how an FMS system works and that we detail below: In most FMS installations, the raw material enters the chain as work pieces or untreated pieces. These parts are stored on a pallet to later be loaded into a work station and located in different areas of the machine tools. The pieces and the pallet are transported through the material handling system to the queuing system of the production machines. The flow of parts in the system is directed directly by the PC, which acts as a traffic coordinator.

After the research carried out by [Chen, et al-1991], [Kim, et al2001] proposed a new definition for a flexible manufacturing process, providing new research results. Therefore, from their perspective, an FMS is conceived as an automated manufacturing system consisting of numerically controlled machines capable of performing multiple functions and an automated material handling system. Control of this system is managed by a computer. As a consequence of this approach proposed by these authors, two types of flexible manufacturing systems are established, unlike [Chen, et al-1991], which did not conceive of such a division.

Parts movement systems: In this system the operations are assigned to the machines and the necessary tools are loaded into the tool program, then the parts are moved between the machines. In this step the part routing plans are determined by the operations allocation decision. Once the tool is loaded into the program, it is no longer changed unless a break occurs.

Tool movement systems: The parts are only treated by a machine to be processed. Once the parts are placed in the machine, they do not undergo any displacement, but the machine is the one that moves with a certain relative movement with respect to the parts. It may be the case that some tools have to be borrowed from one machine to another or brought from the warehouse area. Instead, there is a possibility that the tools are not available for the parts to which they are assigned. Time is one of the most important variables in manufacturing systems. The system has a tool lag due to offsets between all machines. Tool timeout accounts for the majority of tool lag time. The waiting time for this can be affected by the availability of the tool, and its number. The number of tools is called the tool copy setting. Determining this configuration is defined as Tool Requirement Problem Planning (TRPP).

In recent research [Peschke, et al-2005] propose new architectures for flexible manufacturing systems. The new architecture is called PABADIS, which is based on PROMISE (Reconfiguration of product-oriented manufacturing systems). The aforementioned author determines that the PABABIS architecture is characterized by a series of elements:

- ✓ Centralized control architecture in resources. • Integration of the field control interface to improve data exchange.
- ✓ Advanced devices with standard interfaces for distributed control systems,
- ✓ Advanced concepts of distribution of management orders
- ✓ Concepts to describe and compare products and production processes related to specific areas of the industry.
- ✓ Flexible work networks of manufacturing sources through participatory structures.

6. WORK CELLS

In this section, the basic characteristics of the work cells that make up a manufacturing system are exposed. The cells arise with the aim of achieving specialization and greater efficiency in the production chain. In the first investigations on the subject [Freund, et al-1993] they define a work cell as a unit of machinery that cooperates in the workshop, performing externally and autonomously operations of the production process. The cell is made up of automation devices such as robots, machines, and transport systems. Three basic activities or processes are carried out within a work cell, which are detailed below:

- ✓ Product identification. It starts every time a new product arrives in the work cell. This function allows the organization of the system in different products.
- ✓ Internal logistics. The internal logistics activities are the transport and storage of products and parts within the work cell. This activity is controlled by the PLC (programmable logic controller) which is connected to the cell controller in order to allow the flow of information.
- ✓ Production process. The realization of the products, in many cases is usually decentralized from the production process. The machinery used in these cases is made up of robots whose main characteristic is their flexibility. The above process is possible due to the ability of the robots to connect to the cell controller. Next, and by way of application of everything exposed in this section, we are going to present an application of a work cell with multi-agent systems (various intelligent devices, eg robots) for assembly applications.

One of the elements that make up the system is the cell controller. This device is in charge of giving work orders, according to the established process plan. These orders are in charge at all times of defining what

operation should be carried out and what is the associated machinery. In addition, there are two assembly robots in the system that communicate through a product transport system that are supported by two devices that test their operation. The system is also equipped with a set of mobile robots that are responsible for identifying the products involved in the process.

Returning to the investigations of [Freund, et al-1994], which incorporate new elements to the conceptualization of work cells, defining them as a set of automatic devices coordinated by a control system that intervene in the production process, in the case failure of any of the system components. These cells are managed by a cell controller that produces the work orders and integrated into a control and material flow system.

7. ARTIFICIAL INTELLIGENCE AND RPA

Many people tend to confuse the term Robotic Process Automation with Artificial Intelligence (AI), they think they are the same, but no. Although artificial intelligence sometimes uses some RPA techniques, it does not mean that they are the same thing. The difference is that RPA automates simple, repetitive, rule-based tasks; while artificial intelligence makes machines make relevant decisions and simulate human thinking and learning.

When there is little level of analysis, the robot follows business rules and when we have processes with a high level of analysis, automation with artificial intelligence (cognitive capabilities) and predictive models are used so that the robot learns. This is how Javier explains it by adding that not everything can be automated with RPA. Therefore, below, he explains what is feasible to automate and what is not.

- ✓ What processes can be automated?
- ✓ Highly manual and repetitive, they never change shape.
- ✓ High predictability.
- ✓ Prone to errors and rework.
- ✓ Based on business rules.
- ✓ Which are mostly done digitally.
- ✓ What can't be automated with RPA?

Processes in which many decisions are made in their execution or are probabilistic. That require inputs that are not digital. That require external devices for optimal performance.

Dig deeper into this topic by identifying the 6 steps to identify if a process can be automated with RPA

What should a company ask itself before implementing RPA?

In addition, the company must seek to resolve the questions: Why is an RPA initiative valuable to the company? Why are you investing in an RPA initiative? and How is the company going to organize itself to start an RPA initiative? Next, Javier answers each of these questions.

In this webinar Hector Albarracin, Key Account Director of Automation Anywhere, tells us how through the implementation of this tool we can talk about a true digital transformation in organizations. The how specifies the activities that will be traced to carry out the implementation of the RPA initiative. Among those activities are those related to value tests with the different robotic process automation tools to select the one that best suits the economic and functional needs of the organization.

The team that will be in charge of the implementation is defined, whether it will be outsourcing, in-house or a mixed team to work on the lifting, design, analysis, development and evolution of the robots. Finally, and very importantly, the governance model must be established to control robots within the organization, defining roles and responsibilities to prevent RPA from becoming a problem for IT operations, materializing security risks or availability of legacy information systems.

Can a robot replace us? It is a question that many people ask themselves every day and that worries, but it should also help companies to reinvent themselves and see the advantages. According to PwC calculations, 45% of manual activities in companies can be automated, with a notable improvement in your organization in reducing expenses and increasing efficiency. Our Pragmatists Javier Mesa and Camilo Macías make an analysis on the subject.

7.1. Benefits of Implementing RPA

Implementing automation with RPA brings many benefits for organizations both in organizational culture and in performance and continuous improvement of processes because they reduce time and costs. It also offers ease of deployment, as well as the speed and agility that it transmits to companies.

Regarding culture, employees will have more time to train, they will have professional growth, a better work environment; They will also have more time to share with family and friends.

The engineer explains that a robot reduces human error, which implies cost overruns and loss of time, which increases the level of quality of activities, as well as performance. To which is added that it works 24/7, 365 days a year, which helps to see the return on investment much faster.

Organizations will see so many benefits that they will implement robots in their daily tasks to optimize their processes. At that point there is collaboration between humans and robots, technological culture in the areas of the organization, continuous improvement of processes, increased ROI and analysis of the results of the robots.

Meanwhile, the Java architect and RPA expert, Yeismer Espejo Bohórquez, explains that organizations must be able to identify the benefits they will obtain from undertaking this effort and details the most important advantages:

Manual and repetitive tasks that consume many hours of work and the delay in making decisions due to lack of information are two factors that can delay work in an organization.

For this reason, it is recommended to delegate to robots the manual tasks that consume more time so that the team works on new challenges and not waste energy on repetitive actions. The ability to make strategic decisions directly impacts the business; Likewise, eliminating the human burden in these tasks allows us to be more effective.

8. CONCLUSION

When the time for repetitive tasks is reduced from hours to minutes, the number of people dedicated to operational tasks is reduced. This change allows the organization to adjust the size and function of its work teams, reducing the cost of the operation and redirecting the work of people with more strategic and less operational activities. Robotic Process Automation gives companies the opportunity to refocus the tasks and assignments of their employees, so that they spend less time on repetitive activities and more time on tactical or strategic activities that generate greater value for the organization. This allows new roles and business functions to open up that allow for employee growth. Robots can work in continuous shifts and are designed to do so accurately, without delay; increasing operational efficiency by reducing current task execution time and accuracy. RPA systems were designed to create a large amount of performance data. On them, business indicators are defined that are then analyzed to make strategic decisions. This information is used to continuously improve the business process that is being supported and to have exact information on the increase in productivity with the saving of time.

Robotic Process automation is part of the pillars of business automation, bringing organizations closer and closer to the digital transformation of their businesses.

In short, RPA is an ally for companies that seek to innovate and assimilate the challenges they face due to the changes brought about by the digital transformation and the agility that this change requires of us; We can also face the challenge of reinventing ourselves.

REFECENSES

Dale Compton W.“Design and Analysis of Integrated Manufacturing Systems” National Academies, 1988

Davison, D., E., Chen, J. “Classical control Revisted: Re-Examining the basics in the field”, IEEE Control Systems magazine, Feb 2007 Pag 20-21.

DiFrank, P.E.G,"Discussion of the various levels of automation”.Cement Industry Technical Conference Record, 2007. IEEE .April 29 2007-May 2 2007 Page(s):45 – 62.

Freund, E.; Buxbaum, H.-J.;” Universal work cell controller-application experiences in flexible manufacturing” Intelligent Robots and Systems '94. 'Advanced Robotic Systems and the Real World', IROS '94. Proceedings of the IEEE/RSJ/GI International Conference on, Paginas(s):56 - 63 vol.1

Kim, Y.D., Member, IEEE, Lee G.CH., Choi,S.K., Lim,S.K. "Tool Requirements Planning in a Flexible Manufacturing System With an Automatic Tool Transporter" IEEE transactions on robotics and automation, vol. 17, no. 6, december 2001

Mirchandani, P.; Eng Joo Lee; Vasquez, A; Concurrent Scheduling In Flexible Automation, Systems, Man, and Cybernetics, 1988. Proceedings of the 1988 IEEE International Conference on, Volume 2, August 8-12, 1988 Page(s):868 – 872.

Nitzan, D.; Rosen, C.A.; Programmable Industrial Automation, Computers, IEEE Transactions on Volume C-25, Issue 12, Dec 1976 Page(s):1259 – 1270.

Parasuraman.R ,Riley V. A., "Humans and automation: Use, misuse,disuse, abuse," Human Factors, vol. 39, pp. 230–253,1997.

Peschke, J.; Luder, A.; Kuhnle, H..;" The PABADIS'PROMISE architecture - a new approach for flexible manufacturing systems, Emerging Technologies and Factory Automation, 2005. ETFA 2005. 10th IEEE Conference on, Volumen 1, 19-22 Sept. 2005 Página(s):6 pp

Stone R. S .W, Brett. P N,Evans B.S, An automated handling system for soft compact shaped non-rigidproducts, Systems, Man, and Cybernetics, 1996., IEEE International Conference on.

Thurman, D.A.; Brann, D.M.; Mitchell, C.M.;An architecture to support incremental automation of complex systems, Systems, Man, and Cybernetics, 'Computational Cybernetics and Simulation'., 1997 IEEE International Conference on Volume 2, 12-15 Oct. 1997 Page(s):1174 - 1179 vol.2.