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Impact of RPA Technologies on Accounting Systems[*]

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ABSTRACT

Robotic Process Automation (RPA) is a technology that allows the automation of business processes and has a great impact on the transformation of Industry 4.0, which combines the strengths of traditional industries with cutting edge Internet technologies (Schmidt et al., 2015). Companies are able to develop robotic practices, which can define, identify, and most importantly learn applications by using artificial intelligence (AI) capabilities for processing determined transactions, changing data, triggering jobs/transactions, and communicating with other applications and robots.

The aim of this paper is to analyze the implementation and improvement areas of RPA in Enterprise Resource Planning (ERP) and Materials Resource Planning (MRP) within the scope of financial reporting systems in the context of changing cost accounting systems. This paper will also define the effects of RPA technologies in traditional accounting and cost accounting processes and outline the thorough connection between accounting systems, Industry 4.0 and RPA technology. In the light of this revolutionary shift, an overview of the future of accounting function and Strategic Accounting Management (SAM) will be examined.

Keywords: *RPA, Industry 4.0, Automation, Accounting, Cost Accounting.*

Jel Classification*: M41, M15.*

RPA Teknolojilerinin Muhasebe Sistemleri Üzerindeki Etkisi

ÖZET

Robotik Süreç Otomasyonu (RPA), iş süreçlerinin otomatikleşmesine imkan sağlayan ve geleneksel endüstriyelleşmenin birikmiş deneyimini en ileri teknolojiyle birleştiren Endüstri 4.0 dönüşümünde belirgin etkisi olan bir teknolojidir (Schmidt vd., 2015). Şirketler, tanımlayan, tarif eden ve en önemlisi işlemleri belirleyen, veriyi değiştiren, görevleri/işlemleri tetikleyen ve diğer uygulamalarla, robotlarla iletişime geçebilen yapay zeka kapasitelerini kullanarak öğrenebilen robotik uygulamalar geliştirebilmektedir.

Bu çalışmanın amacı, RPA'nın Kurumsal Kaynak Planlaması (ERP) ve Malzeme İhtiyaç Planlaması (MRP)'de değişen maliyet muhasebesi ve finansal raporlama kavramları kapsamında uygulama ve gelişme alanlarını analiz etmektir. Bu çalışma aynı zamanda RPA teknolojilerinin geleneksel muhasebe ve maliyet muhasebesi süreçlerine etkisini incelemekte ve muhasebe sistemleri, Endüstri 4.0 ve RPA teknolojileri arasındaki derin bağlantının ana hatlarını çizmektedir. Bu devrim niteliğindeki değişimin ışığında, geleceğin muhasebe fonksiyonu ve Stratejik Muhasebe Yönetimi (SAM) incelenmektedir.

Anahtar Kelimeler: *Robotik Süreç Otomasyonu, Endüstri 4.0, Otomasyon, Muhasebe, Maliyet Muhasebesi*

JEL Sınıflandırması: *M41, M15.*

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1. INTRODUCTION

In recent years, business world has faced with new developments and challenges such as globalization, global crisis, climate change, global political instabilities, intense market demands, wild competition, outsourcing, cyber threads and disruptive technologies. (Elkington *et al*., 2017: 1, 2, 5, 13, 16). In this VUCA (Volatility, Uncertainty, Complexity and Ambiguity) world and with the ever increasing shift toward complexities, businesses experienced difficulties in managing these technological, economic and social developments (Mack *et al*., 2016: 3-10).

Technological changes began with digitalization and mobile technologies and followed by other disruptive technologies such big data, data analytics, mobile technologies and smart devices, cloud technologies, social media, IoT (Internet of Things), IIoT (Industrial Internet of Things), automation and robotics and Industry 4.0. The term "Industry 4.0" originates from a project in the high-tech strategy of the German government, which promotes the computerization of manufacturing and the term was revived in 2011 at the Hannover Fair. In October 2012, the Working Group on Industry 4.0 presented a set of Industry 4.0 implementation recommendations to the German Federal Government (Kagermann *et al*., 2013: 15-26). It is a revolutionary transformation in which, sensors, machines, workpieces, and IT systems will be connected along the value chain beyond a single enterprise and local departments and functions will be more integrated as cross-company, universal data-integration networks evolve (Rüßmann *et al*., 2015: 4-6). One of the core technologies as a sub-technology of industry 4.0 model is RPA.

"*Robotic process automation is the application of technology that allows employees in a company to configure computer software or a "robot" to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems*" (IRPA&AI, 2017a). When we compare industrial robots with RPA robots, industrial robots increase production efficiency by increasing production rates, improving quality and reducing production costs versus "RPA "robots" revolutionize the way we think about and administer business processes, IT support processes, workflow processes, remote infrastructure and back-office work. RPA provides dramatic improvements in accuracy and cycle time and increased productivity in transaction processing while it elevates the nature of work by removing people from dull, repetitive tasks." (IRPA, 2017a)

Automation in production with Industry 4.0 will completely change the business processes. Mostly labor force and related cost structure will change and all business systems will be affected by the automation of accounting, sales, logistics and management reporting processes and business cycles. In this disruptive change, accounting should functionally shift to strategic management accounting.

Human robotics or humanoids and industrial robotics are not included in the context of this study, which is completely different subject and discipline. As a definition, robotics is used for robotic software and applications in this study.

2. TECHNOLOGY BEHIND RPA

Robotic Process Automation is a combination of related technologies such as autonomic systems, machine learning, AI and robotics. These emerging technologies shaped the structure of RPA solutions and became a framework for RPA. It works by clearly replicating the activities that today's workforce currently undertake, using existing core applications, accessing websites, and manipulating spreadsheets, documents and email to complete tasks (Lamberton, *et al*., 2017: 10-13). Although the term -RPA connotes visions of physical robots wandering around offices performing human tasks, the term really means automation of service tasks that were previously performed by humans. For business processes, the term RPA most commonly refers to configuring software to do the work previous done by people, such as transferring data from multiple input sources like email and spreadsheets to systems of record like ERP and Customer Relationship Management (CRM) systems (Lacity, *et al*., 2015: 3-4). as well as benefiting it (KPMG, 2017).

German Federal Ministry of Education and Research and German Industry 4.0 Working Group is giving detailed information about the roadmap, strategy and evolution of Industry 4.0 initiative (Kagermann *et al*., 2013: 15-26). To understand RPA technology and its effects on business processes (especially in accounting), it is vital to fully understand the Industry 4.0 initiative as it strives to efficiently optimize business processes by eliminating non-value-added elements. The relation between RPA and adoption of Industry 4.0 and other related technologies will be reviewed under our further researches.

2.1. Autonomics

The term *autonomic computing* has been first used in an IBM manifesto in 2001, which was stating that main obstacle in the progress of IT industry is the software complexity. Today even individual applications and environments have millions of lines of code and this complexity grows when these applications and environments connect to the internet and begin to communicate with each other. Manifesto points out that this complexity is ever growing with the interconnectivity and integration in the Internet era and managing this complexity is beyond human capability. Manifesto identifies *autonomic computing*, computing systems that can manage themselves, as a remedy for managing this complexity (Kephart and Chess, 2003: 41-45).

IBM also defined the main self-management attributes of system components: self-configuring, self-healing and self-optimizing. Self-configuring is the adaptation of systems to changes in the environment, self-healing is self-recovery against disruptions, malfunctioning, errors or anomalies, and self-optimizing is monitoring resources and auto-tuning these resources at optimum and\or desired levels. (IBM, 2015)

An autonomic system is identified by eight characteristics (Murch, 2004):

- Knows what resources it has access to, what its capabilities and limitations are and how and why it is connected to other systems.

- Is able to configure and reconfigure itself depending on the changing computing environment.

- Is able to optimize its performance to ensure the most efficient computing process.

- Is able to work around encountered problems either by repairing itself or routing functions away from the trouble.

- Is able to detect, identify and protect itself against various types of attacks to maintain overall system security and integrity.

- Is able to adapt to its environment as it changes, interacting with neighboring systems and establishing communication protocols.

- Relies on open standards and requires access to proprietary environments to achieve full performance.

- Is able to anticipate the demand on its resources transparently to users.

2.2. Machine Learning

Learning is a very complex and multidimensional process, which is consist of different but related dimensions such as getting data, analyzing data, forming inter-relations and forming knowledge, developing motor and cognitive skills by using practice and post-practice analysis, and at the end through observations and experiments forming the applicable knowledge and observing, following and gathering data after application. Machine learning is the transformation of the learning process into the machine by using computers. In other words, detection, correlation, and pattern recognition generated through machine-based observation of the human operation of software systems along with ongoing self-informing regression algorithms for machine-based determination of successful operation leading to useful predictive capability.

Since the inception of the computer era, researchers have been striving to implant such capabilities in computers. Solving this problem has been, and remains, a most challenging and fascinating long-range goal in AI. The study and computer modeling of learning processes in their multiple manifestations constitute the subject matter of machine learning.

2.3. Cognitive Computing

Cognitive computing is a technology, which integrates and collaborates human intelligence with machine intelligence. Intelligent, cognitive systems work with different types of data. Haun (2014: 28-37) defines the cognitive computing as the key theory that constitutes basic structure of RPA and AI; and discusses evolution and future of cognitive systems. Cognitive systems designed to work with structured and unstructured data such as text, image, and video like other IT systems. However, the most important difference when we compare cognitive systems with other IT systems is that they learn, model and generate hypotheses (Hurwitz *et al*., 2015: 1-37).

Cognitive systems are designed to:

- Sense, observe, perceive the environment and collect data\information.

- Comprehend and learn (analyze and understand the data\information collected).
- Act (make informed decisions and provide guidance based on analysis in an independent way)
- Adapt (adapt capabilities based on experience learning by experience) in ways comparable to the human brain (Haun, 2014: 28-37).

Burgess (2017) and Russell and Norvig (2016: 1-31) deeply analyze and define the development of AI systems.

2.4. Artificial Intelligence

AI is the combination of cognitive automation, machine learning, reasoning, hypothesis generation and analysis, natural language processing, and intentional algorithm mutation producing insights and analytics at or above human capability. AI will be the next stage in the maturity roadmap of the robotic automation.

Burgess (2017) discusses the importance of AI and states that: "Artificial Intelligence, in its broadest sense, will have a fundamental impact on the way that we do business. Of that there is no doubt. It will change the way that we make decisions, it will enable completely new business models to be created and it will allow us to do things that we never before thought possible. But it will also replace the work currently being done by many knowledge workers, and will disproportionally reward those who adopt AI early and effectively. It is both a huge opportunity and an ominous threat wrapped up in a bewildering bundle of algorithms and jargon."

The Turing Test, which is found by Alan Turing in 1950, defines an operational definition of intelligence and acting humanly (Turing, 1950: 433-460). A computer passes the test if a human interrogator, after asking some written questions, cannot tell whether the written responses come from a person or from a computer. A Computer should have the following skills to pass the Turing Test:

- **Natural language processing** to enable it to communicate it and especially communicate with others,

- **Knowledge representation** to store what it senses, hears, observes, knows and learns,

- **Automated reasoning** to use the stored information to answer questions and to draw new conclusions;

- **Machine learning** to adapt to conditions and changes, and to detect and draw conclusions from patterns.

- **Computer vision** to perceive objects.

- **Robotics** to manipulate objects and move about (Russell and Norvig, 2016: 1-31).

Murch (2004) discusses the basics of autonomic computing. Autonomic Computing is a framework for automated software and understanding this framework is crucial for understanding basics of RPA and AI.

In the future, the next phase in robotic systems will be acting exactly like a human with AI and cognitive computing. There is evidence in the literature that in near future, all processes conducted by human including learning and decision-making will be replaced by robotic systems (Russell *et al.*, 2016).

3. BENEFITS OF THESE EMERGING TECHNOLOGIES

Process automation applies robotic and cognitive technologies to automate routine, manually operated and standardized tasks in support of an enterprise's knowledge workers. The robotic software eliminates the human dependency by freeing human employees from these routine tasks to give a chance to focus on core business objectives and operations. Automation offers many compelling benefits to the workplace and effective and strategic human resource management.

3.1. Cost Reduction

Robotic process automation can create a 25-50% cost savings; enables 24x7x365 execution and, can work error-free, and is relatively costly when compared with human work and capacity. A software robot can cost as little as one-third of the price of a full-time offshore employee (FTE) and as little as one-fifth the price of an onshore FTE (Petersen and Rohith, 2017: 74-81).

Before automation, a Business Process Outsourcing (BPO) service provider, one that handled the application for processing insurance benefits employed a full-time human employee who could complete the process in an average of 12 minutes. Automation software completed the process in one-third the time, tripling the transaction volume for one-tenth of the FTE cost. By automating this single process, the provider achieved a positive return on this investment within six months (Petersen and Rohith, 2017: 74-81).

3.2. Higher Efficiency

RPA/AI offers an improved service delivery model by increasing production and accuracy, reducing cycle times and decreasing the need for ongoing training. Unlike humans, robots can perpetually work 24 hours a day and seven days a week. Typically, one robot can do the work of two to five FTEs.

An enterprise user of an IT infrastructure automation tool suite that was designed to work with existing investments improved its overall operational efficiency by cutting its mean time to resolution by 60 percent and by handling over half of its IT problems without manual intervention (IRPA, 2017b).

3.3. Advanced Analytics

Process automation makes gathering and organizing data easier, so a company can predict future outcomes and optimize their processes. Advanced analytic techniques create a feedback loop. The analysis determines areas of improvement, and the improved processes, in turn, produce more specific data that allows for further improvement of operations and higher levels of efficiency. Advanced analytics is an essential element in achieving regulatory compliance, cost-effective growth and optimized operations.

3.4. Performance and Quality Improvement

Nature of human work includes error. Risk of malfunction, error and fraud in manual systems is always higher than automated systems. Robots are trustworthy, consistent and tireless. They can perform the same task the same way every time without error or fraudulence. RPA/AI optimizes capabilities that grow organizational capacity (Petersen and Rohith, 2017: 74-81). After deploying automation software to support a number of IT processes, one company was able to increase organizational productivity and capacity without extra recruiting or training. They achieved payback in approximately 15 months with a calculated return on investment of 141 percent and concluded that they could expect greater returns as they continued to automate more workflows.

4. BENEFITS AND RISKS OF RPA

The benefits of RPA solutions go beyond cost reduction and include:

- Decreased cycle times, improved throughput and efficiency
- Can act on data from one or multiple sources in different formats
- Manages, process or interprets the data according to established rules
- Can communicate the result to another digital system, trigger another task on these systems, or create an alert
- Flexibility, scalability, easiness in implementation and development.
- Improved accuracy
- Improved FTE and employee morale – enables them to add more value
- Allows time to innovate and focus on customer satisfaction
- Detailed data capture (Deloitte UK, 2017; Deloitte US, 2017)

5. IMPLEMENTATION AREAS

The technology of RPA can be applied specifically to a wide range of industries.

5.1. Process Automation

RPA applications can be easily implemented without compromising existing IT architecture and without increasing its complexity. They can easily automate vital business processes in different departments such as production, finance and accounting, sales, procurement, supply chain management, customer service and human resources. Process automation can simplify and accelerate back-office tasks in finance, procurement, supply chain management, accounting, and customer service (Powel, 2017: 3-7).

RPA applications can handle following -but not limited to- manual and routine functions:

- Opening, reading and sending emails and attachments.
- Automated Internet application processing: Logging into web/enterprise applications or reading\entering\deleting or changing data in any web\enterprise.
- Automating data cleansing: Moving, changing or deleting files and folders.
- Automatically connecting to system APIs and uploading or downloading data
- Automatically running batches.
- Automatically following “if/then” decisions and rules.
- Automatically extracting and reformatting data into reports or dashboards.
- Automatically extracting structured data from documents, formatting any data.
- Automatically collecting and analyzing social media data.
- Automatically collecting and processing data from multiple data resources, working with different data types, from structured and unstructured data.
- Automatically making calculations and executing tasks or jobs due to the results of these calculations.
- Automatically filling in forms.
- Automatically connecting, reading and, writing to databases.
- Automatically generating\sending\sharing reports.
- Automatically generating early-warnings.
- Making auto-corrections, block or stop transactions above the limit or threshold.
- Automating fraudulent account closure process and fraud chargeback processing.
- Making automatic bookings in accounting.
- Making auto-monitoring and auto-corrections on accounts.

- Executing, changing or correcting standing order details
- Executing, changing or correcting direct debit details
- Executing, changing or correcting address details
- Auditing, blocking or correcting transaction duplications
- Automating branch risk monitoring process
- Automating personal loan application opening
- Payment protection insurance claims processing
- Automation of the administration of payment terms
- Automated support for sale of insurance products
- Automated marketing campaigns
- Customer complaints automation
- Compliance reporting automation
- Insurance product administration automation
- Automated risk analysis and automated execution due to this risk analysis
- Automated direct debit cancellations
- Automated personal account closures
- Automated payment processing
- Automated business account audit requests
- Automated business account onboarding
- Automatically excessing transaction approvals
- Automatically excessing check approvals
- Automatically excessing customer letters (Deloitte, 2017; IRPA, 2015)

5.2. IT Service Desk Operations

RPA can improve management, monitoring and reporting of devices in IT infrastructures, achieve operational excellence and can consistently investigate and solve problems for faster process throughput. "*Separating scalability from human resources allows* *a company to handle short-term demand without extra recruiting or training.*" (IRPA, 2017b).

Additionally RPA will reduce the need for routine support effort. With RPA, labor costs will decrease and efficiency of IT personnel will increase.

6. RPA TECHNOLOGIES AND THE ACCOUNTING FUNCTION

Finance and accounting functions are the living organs of the organizations, and they are always under pressure in terms of keeping up with improvements, and new technologies. RPA technologies will affect the accounting and finance surely.

An automated accounting workplace will change the role of an accountant significantly. Many time-consuming, manual process jobs will replace with technology and robots, thus accountants can find a chance to focus on strategies and analyses. According to Axson (2015), transactional tasks will move to integrated business services solutions that use robotics, and that will automate or eliminate up to 40% of transaction accounting work by 2020. As a result, the staff can spend more time on decision support, predictive analytics, and performance management.

This technology not only improves the time efficiency of accountants, but also creates real-time access to financial data, thus reporting and analysis can be done simultaneously and continuously. RPA is not replacing accountants; it evolves their job in a progressive, and positive way and enables them to focus on the greatest value they can provide to their organization (Spanicciati, 2016).

Within the scope of RPA, fundamental changes await cost management practices. As direct labor will begin to decrease gradually, the formation of product cost will be omitted from the definition of conventional prime cost. With the advance of Industry 4.0, remaining blue-collar workforce - if any - will have to improve their technical skills. Cross-functionality will dominate this new understanding of work practice. As variable-natured direct labor will exit the equation of cost calculations, intangible asset size will increase and amortization as a fixed-natured expense will be a material part of product cost. Additionally, such system will require continuous improvement (Reinnarth *et al.*, 2018: 147-154, 155-162).

From a strategic forecasting point of view, firms will have to allocate significant funds for both betterments to enhance/modify the RPA systems; but also for maintaining and support, which falls within the jurisdiction of operating expenses. Nevertheless, it is evident that the conventional and obsolete cost management systems will fail unless firms take preventive action in order to modify their strategies to fit into this new way of thinking. While these improvements, financial accounting function will receive their share of restructuring as well (Cline *et al.*, 2016: 5-9).

Crucial roles such as accounts receivables and account payables will be threatened critically as the RPA system will automatically enter data, some accounting staff will be still being employed for monitoring paperwork. As, RPA can be used in every step of accounting flow, in operational accounting, billing and collection will be able to be followed and progressed by robots. Account reconciliations can be performed in an efficient way by using automation. Accounts payables and accounts receivables will be reconciled by robots both in one-way or two-way transactions with customers and vendors (Cigen, 2017).

In general accounting side, transaction and invoice-to-PO (purchase order) matching can be processed by RPA. For the journal entries, central journal entry management to control creation, review, and approval of journals are done with electronic certification and supporting documents. Moreover, automation of pre-posting validation is performed in order to catch entry or logic errors, ensure accuracy, and eliminate general ledger and sub-ledger rejections (Schatsky *et al.*, 2016: 1-5).

All allocations and adjustments can be done by RPA in general accounting. After reconciliations of the bank, credit cards, credit recordings, etc., and the intercompany transactions, robotic programs are able perform closing and consolidation activities. As for the finance function, treasury transactions can be followed up via RPA as well. After the closing process, RPA can provide enhanced financial reporting both for internal and external purposes. There will be an automated reporting which enables early warning with custom-made, and present report users real-time reporting, which helps them in proper monitoring (McIntosh-Yee, 2018).

RPA can perform planning and budgeting activities in the controlling function, and provide numbers of scenarios in a short time period, which make the decision process more effective. Long-term as well as short-term plans can be constructed in a proper way, because of advanced forecasting function of RPA (EY, 2017: 4-6).

In the controlling and auditing function, there are two specific sides of RPA. Firstly, auditors will be benefited from robotics in regular internal control activities. As an example, if required controls are missed or any action does not fit the programmed rules or pattern, the robot flags the transaction, and warns the auditor for reviewing and searching more in depth. This will help audit teams to save time, act proactively and, focus on the more analytical side of their job as seen in the accounting and finance function. RPA will also serve for risk management, and it is expected to decrease fraud risk as well as human errors (Vasarhelyi *et al.*, 2018).

Additionally, auditors will need to audit robotics. There are certain degrees of risk with any type of automation. RPA has its own learned-algorithm, and a faulty algorithm may have an enormous impact on hundred bots using the same faulty algorithm. Thus, without human checking, there could be some dramatic and catastrophic results. An auditor should audit the RPA

Recent studies shed light on the benefits of RPA solutions to the extent that using RPA in accounting transactions such as reconciliations, automatic booking or automation of manual transactions and in financial operations like consolidation and reporting will change drastically (Powel, 2017: 3-7).

7. CONCLUSION AND FURTHER RESEARCH

RPA technology has been thoroughly reviewed in the context of Industry 4.0 and its effects on business processes and operations such as accounting have been discussed. It is clear that RPA and related other technologies will reduce the dependency to human work, reduce costs and increase efficiency in business operations. RPA will especially improve error-free and accurate transactions in accounting and increase the efficiency and effectiveness in monitoring and auditing transactions.

Automation using AI will be next game changer in business and RPA will be the entry point in the roadmap of robotic automation and evolution of robotics, and will be used - extensively and increasingly - in the business processes in the following years. Even the replacement of human workforce and jobs in some business with robots or robotic systems are also being discussed in recent research and studies.

RPA and automation will disruptively change the processes, transactions and excursion in accounting. Especially inefficient accounting operations will be handled by RPA and accounting professionals will concentrate more strategic operations in the context of Strategic Accounting Management. RPA will also ensure the automated internal control\auditing and automated critical financial reporting.

Currently, adoption of RPA in Turkish market is not broad yet. Accordingly, by the increase of RPA usage in Turkish business market in the following years, we plan to research on the implementation of RPA projects in Turkish companies, and to analyze successful case studies in the organizations. Additionally, we plan to review correlation and relation between RPA and other Industry 4.0 projects such as AI, plant automation, IoT, mobile technologies and digitalization as well.

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