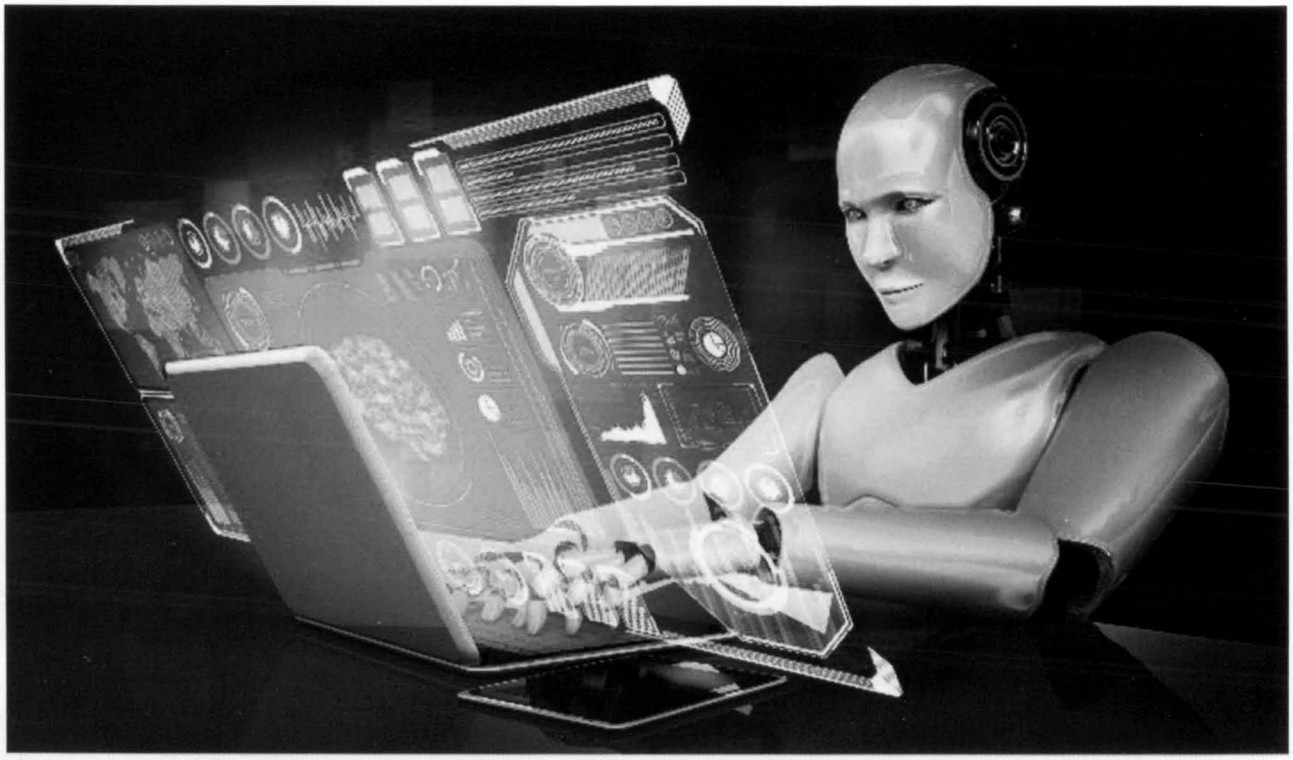

DIGITAL TRANSFORMATION WITH INTELLIGENT ROBOTIC PROCESS AUTOMATION (RPA)

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Introduction – Evolution of Automation

Historians could trace the use of waterwheels by Greeks and Romans for lifting water from lakes, rivers, and other water bodies way back in the first century BC, albeit the actual date could not be confirmed. Long thereafter during 9th century AD mechanical windmills were reported to be made by the Persians for grinding grains. According to Nathan Bong, an automation engineer of Canada, these are regarded as the first few instances of automation. He has supported his comment by quoting a publication of NASA[1] On a hindsight these may be regarded as automation in the simplest form because the advanced instances of automation in present era Industry 4.0 cannot and should not even be compared.

Such a process of innovations for automation continued to evolve. During the first industrial revolution between 17th to 18th century many instances of automation happened with mechanical applications driven by wind and water energy. The first ever complete process of industrial automation is said to be brought by Oliver Evans when he created a flour mill which could run automatically and continuously. During the second industrial revolution electricity helped hundreds of automations with more versatilities which played larger roles for society by increased speed of output generation, productivity, safety, quality, and convenience. With the advent of computer science integration of software with machines' operating systems brought in further innovations and ensured higher levels of controls in the process automation.

Through the continued process of evolution present day

Image Source: *https://en.compubase.net/RPA-Robotic-Process-Automation-Welcome-Page_a481.html*

industrial revolution saw advanced levels of automation by integration of four disciplines of engineering, viz., Mechanical, Controls. Computers and Electronics, which is known as Mechatronics[2]. It reached automation to the overwhelming levels when mechatronics powered by cognitive technologies gave birth to Robots. The idea of a robot doing jobs induced digital technologists to deliver another variety of automation which is an integrated set of software only. It can do repetitive jobs automatically and flawlessly which even without adding any additional physical device and almost zero human intervention. In this lies the essence of Robotic Process Automation (RPA). When an entity uses multiple sets of RPAs into its working process, it considered to have created and deployed a virtual team of workforce.

Mikkel P Grover[3] defined in Britannica encyclopaedia in 2018 automation as, *".... application of machines to tasks performed by human beings or, increasingly, to tasks that would otherwise be impossible. .... automation generally implies the integration of machines into a self-governing system. Automation has revolutionized those areas in which it has been introduced, and there is scarcely an aspect of modern life that has been unaffected by it"*. This definition objectively corroborates the drivers of automation in the aforesaid historical events of automation in previous few centuries of industrial revolution. It endowed automation with the predominant feature of reducing and/or eliminating human efforts from jobs hitherto being completely performed and delivered by human beings with the help of a self-governed system. And the second objective of automation is to perform tasks which are impossible to be accomplished by mankind. But interestingly Grover has not used the word 'computer' in his quoted definition.

Christian P Janssen et. al[4] conducted their seminal research work (2019) by analysing the papers on human-automation interaction and was published in the International Journal of Human-Computer Studies during the last 50 years. They concluded that *"..... over the years, automated systems have been used more frequently (1) in time-sensitive or safety-critical settings, (2) in embodied and situated systems, and (3) by non-professional users."*

Between the aforesaid definition of Grover and this research finding, in which computer has been brought into picture, the objectives of automation continued to remain common. The core essence is to transfer jobs of human beings to a self-governed system which can function by itself, without any error, and complying with the policies, systems and processes and legislated stipulations and regulations that human beings used to follow, yet getting the voluminous jobs done with higher speed, quality but at lower cost in an error-free manner. The genesis of RPA therefore lies in Bill Gate's statement, "The first rule of technology used in a business is that automation applied to an efficient operation will magnify the efficiency."

Objective

This paper aims at developing a fundamental understanding about RPA and the Toolkit that is applied for its implementation. It would try to break the myth that any robotic process automation essentially needs a robotic device which is a physical product of mechatronics. It would attempt to convey that RPA is essentially an art and science of creating software architecture and digital solution designing for integrating and automating cross-functional activities even in an ERP system environment. This paper would also introduce the emerging professional field of process mining that facilitates setting objectives of any digital solution designing and selecting the technologies that would be required for the same while working on a RPA process.

RPA - What and How

It should at the outset be made clear that, contrary to popular belief, robotic process automation does not involve any mechatronic instrument, device or an object like a robot or humanoid. It is just one integrated computer software embedded with the powers of both ICT and digital technologies. IBM[5] has defined Robotic Process Automation (RPA) as *"....software robotics, uses automation technologies to mimic back-office tasks of human workers, such as extracting data, filling in forms, moving files, et cetera. It combines APIs and user interface (UI) interactions to integrate and perform repetitive tasks between enterprise and productivity applications. By deploying scripts which emulate human processes, RPA tools complete autonomous execution of various activities and transactions across unrelated software systems."* This definition has been further elucidated by two short examples in a subsequent section.

RPA as a technological toolkit for workflow process automation is heavily dependent on its predecessor technologies. That is why it is commonly said that RPA in its true form emerged around the year 2000, i. e., just about two decades before as compared Arthur Samuel's discovery of Machine Learning in 1959. It necessitated adoption of:

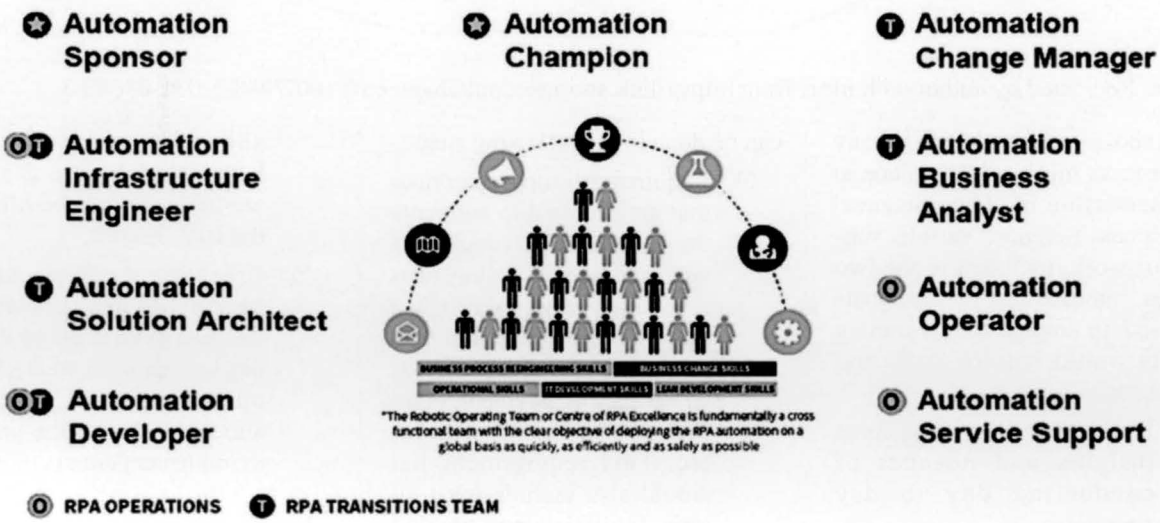
- **Cognitive Technologies** like Artificial Intelligence (AI) for doing jobs that need human beings' typical cognitive skills which can be emulated using digital technologies. This ability helps the system to recognise physical figures, images, speeches, etc.
- **Machine Learning (ML)** for learning more about data the way human beings

learn, and translation of texts from different languages and appropriately making summaries of the same to be applied for automation,

- Screen Scrapping using optical character recognition tools for extracting data from changing web pages, digitalised documents, etc., and
- Natural Language Processing or NLP as a branch of AI to build in the capability in a computer to recognise and understand text and spoken language or speech with as much precision as a human being can. In a reverse process NLP can convert something written or generated by the computer in structured language into voiced out speech. A simpler version of it is experienced, when money received through a UPI payment process, from a simple device confirming through a voiced message the exact amount of money received by the system.

Thus, RPA can collectively be called as a 'Toolkit of Software'. In the advanced stage of intelligent RPA another higher level of cognitive technology is used which is known as:

- Sentiment Analyses (SA) which IBM[6] has defined in a simple way as efforts made by a digitally powered device to *"... extract subjective qualities—attitudes, emotions, sarcasm, confusion, suspicion - from text."*



Source: https://www.auxis.com/blog/rpa-business-analyst

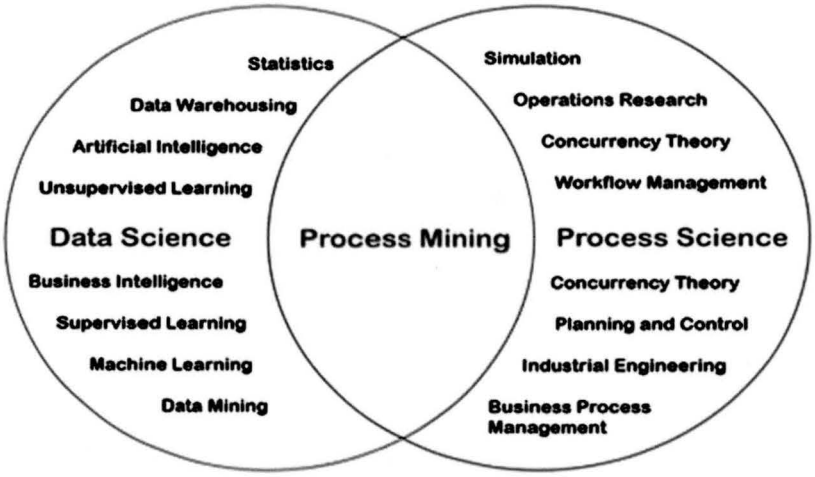
The above graphic explains various aspects of the RPA solution designing process by applications of the Toolkit. The solution would be crafted by contributions of many experts. They would combine inter-disciplinary knowledge of advanced ICT and digital technologies, for multipurpose work automation with in-built intelligence and cognitive skills. The question can come about the role of AI in RPA when a physical device like a robot or a humanoid is absent in the Toolkit.

Automation as an innovation was substantially achieved with applications of computers and mechatronics even before the onset of Industry 4.0. Digital scientists took over the baton and struggled for making automation an intelligent process so that tasks that require human intelligence can also be taken over by computing systems for avoiding human interventions and thus breaks in the automated chain of workflow. Such a necessity was more felt for automation of tasks of service deliveries like in BFSI and FinTech sectors, eCommerce, governmental services, academia, research, and social media.

Process Mining

One of the important tasks before deciding to deploy RPA Toolkit for cross-functional business process automation with more intelligent capabilities embedded in the entire system is 'Process Mining. This is developing as an important professional discipline which can successfully work at the intersection of 'Process Science' and 'Data Science' to help decision making execution with optimised resources. It helps to rediscover and know in depth the existing systems, processes and tasks which are presently being performed by the ERP systems with multiple points of human interventions that need to be automated to derive benefits with reduced chances of error, increased speed, and power of analyses. It also helps in identification of process events and logs, modelling of process data and conformance checking that are essential to ensure compliance of related policies, rules, regulations and

meeting financial obligations to government agencies.



Source: Recreated by author with ideas from https://link.springer.com/chapter/10.1007/978-3-031-08848-3_1

The above graphic aims to convey that process mining takes place at the intersection of 'Data Science' and Process Science. Various sub-areas of work, included in the two spheres, indicate that professionals who wish to engage in this mining activity would require skills and competencies in:

- Understanding business insights and nuances of conducting day to day operations,
- Appreciating the pain points of an entity's business activities including for cross functional collaboration and coordination,
- Business process consulting,
- Communication and problem solving,
- Ensuring effectives applications of cognitive technologies for value addition,
- Data base management and data analytics, etc.

Therefore, process mining is to be done with a multi-disciplinary approach. RAGE analyses can successfully be applied for process mining to ensure effective and purposeful deployment of the intelligent RPA Toolkit. The analyses can be done in the following steps:

- Required: All support services that are required to automate the present SOP in compliance with policies and statutory rules regulations, e. g., value added tax, income tax deduction at source (TDS and TCS) while making payment, other dos, don'ts, and restrictions, etc. This requirement list would also include what all new facilities are needed by management and can be created by applications of AI, ML, Screen Scrapping, SA as have been narrated above. The second set of requirement analysis would be of immense importance for entities engaged in industry sectors like FinTech, eCommerce, Healthcare, Agriculture and Agrotech etc.
- Available: Identify what the existing ERP system performs without any human intervention, e.g., stoppage of supply and sales billing to a customer if the approved credit value limit exceeds because of the present billing done and so on.
- Gaps: A comparative study of the lists prepared by the above two analyses would help identifying the gaps that are to be and can be filled by the RPA Toolkit,
- Essential: Analysis in this step would help prioritising the gaps to be filled up during implementation of RPA and optimisation of resource allocation during the process of implementation in tranches.

The benefits by including cognitive technologies in the RPA Toolkit would be collection, collation, and meaningful analyses of huge data, including by scrapping of documents, sentiment analyses, etc. as have been narrated above. All these in turn would help formulation of business strategies and taking decisions for effective execution at the marketplace.

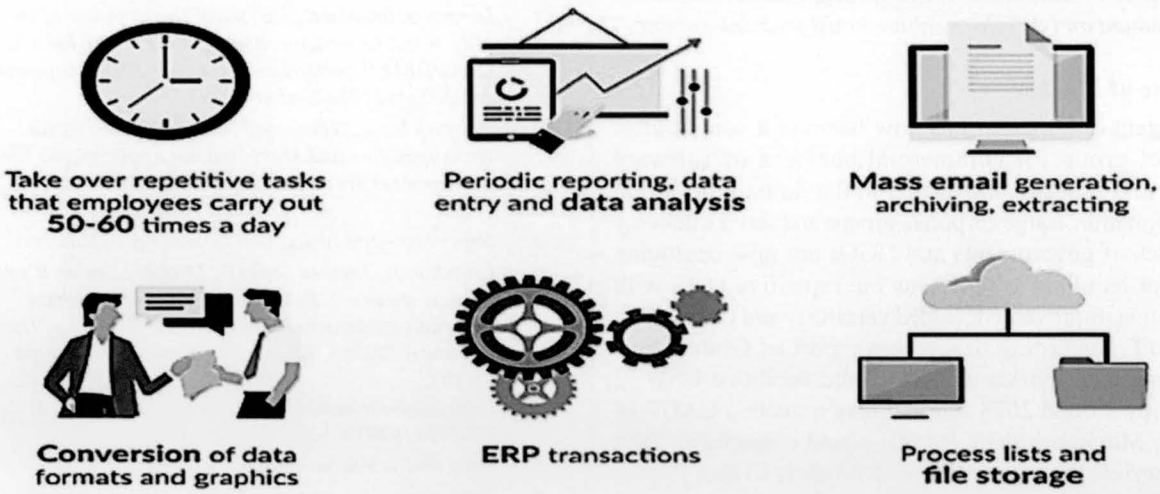
Caselets on RPA

The entire concept of RPA can be elucidated by the following caselet. Let it be assumed that a company runs an ERP system including modules for Order to Sales, Profit and Cost Centre-wise Accounting and Reporting (FI-CO), Treasury, Plant Management, etc. The reality may be that the ERP system has been configured to functions in a hybrid manner with both manual

and automated tasks, e. g., capturing of orders received from customers, invoice raising and collection accounting, generating reminder mails, etc. Moreover, between the two modules requiring cross functional inputs, customisation might have not been done for seamless integration.

Despite prevalence of ERP systems between two modules the system would operate with many human interventions due to breaks in the chain of workflow. For example, orders received from customers and inventory management and procurement related data may be manually entered into production planning and scheduling module. Such events of manual interventions break the chain of cross-functional process workflow while creating the manufacturing schedule and queueing of orders for fulfilment by dispatches of goods from warehouses and/ or manufacturing plants. The ERP system generally do not by itself have any automatic forecasting module unless it has added with facilities for analysis of past data, study of customers' buying behaviour and so on. RPA tool kits available with service vendors who can automate the entire process.

Readers can learn more about applications of RPA from a contribution of Bernard Marr at https://bernardmarr.com/10-amazing-examples-of-robotic-process-automation-in-practice/



Source: https://www.uipath.com/blog/rpa/the-robotic-process-automation-infographic

The next example of RPA could be for a bank's systems for receiving applications along with documents for retail consumer loan against capital assets, processing, approving, disbursement, issuing reminders for timely instalment payments, analysis of overdues and determination for defaulters for issuing legal actions. The author has explained the entire process, including integration with the eCommerce Platforms of the sellers of those items, in his article under this monthly Column of September 2022.[7] Support services that a bank's customer receives while using the net banking facilities through a Chatbot is also an example of RPA from the perspective of banks to avoid the customer calling their cost centre executives to get the help.

Deloitte conducted a survey in 2022 amongst about one hundred leaders of shared service providers to assess suitability of RPA applications. The results revealed that about 22% of respondents have already implemented RPA in pilot or full scale, and 74% have planned to examine RPA as a technology within a year. In their report[8] Deloitte added that, *"Those who had implemented identified that RPA meets or exceeds their expectations in terms of financial benefits, and reality tends to outperform expectations even further with non-financial benefits."*

Benefits of RPA

Readers by now must have appreciated the RPA as a Toolkit for intelligent automation of repetitive tasks and guessed the benefits that can be derived from it. The following can be an illustrative but not comprehensive list of benefits from RPA:

- Saving manpower and other operating resources for performing repetitive functions
- Seamless integration of cross functional workflows,
- Minimisation scopes and chances of human errors, frauds, compliance misses, etc.,
- Increased efficiency with speed and higher quality of seamless and reliable service deliveries to stake holders with zero error,
- Handling millions of customers widely spread across geographies by a centrally administered RPA solution which is a necessity for industry sectors like BFSI and FinTech, eCommerce, aviation, etc.,

- Applications of cognitive technologies and data analytics that helps in ascertaining customers' behaviour across geographies and demographic patterns, formulation of business strategies and implementation of execution tactics

In the ultimate analysis RPA helps in ensuring risk-enabled performance management when the genesis of risks could be in both internal and external business environment. According to Deloitte[8], *".... relevant RPA tools, organisations can create a seamless back office by automating rule-based business processes thus allowing you to effectively deploy your more highly experienced personnel to add more value through direct customer engagement and therefore enhance customer interaction."*

Volume of Market

Intelligent automation has now become a sought-after product group for commercial business of software giants and process consultants in the domain of digital transformation. Large corporate groups and service delivery agencies of governments and NGOs are now deploying RPA for handling voluminous but repetitive tasks with qualitative improvement, added versatility and cost-benefit trade-off. According to a recent report of Grand View Research RPA market in USA would be above USD 12 billion by around 2028 and that may register a CAGR of 32.8%. Maximum share for this would come from 'RPA as a Service' the present share of which is 61%.

There are plenty of RPA consulting firms that offer advanced and intelligent RPA Toolkits. One of the websites where readers can get updated information on this is https://www.softwaretestinghelp.com/robotic-process-automation-tools/. Similar such service providers are also there in India.

Conclusion

RPA as a professional discipline is developing in Asia. In the USA and Europe its speed of applications has picked up momentum. It is both an evolving and emerging field where solutions are to be designed with multidisciplinary approach. The author will feel happy if this article meets the first hand requirement of readers in gathering knowledge and information of robotic process automation. RPA as a subject can also be clubbed with physical mechatronic robots for applications in various industry sectors. Shall look for a similar such space to write more on the combined subject. MA

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