

THE NEXT GENERATION INTELLIGENT AUTOMATION: HYPERAUTOMATION

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ABSTRACT

One of the buzzwords in the technological world is “Hyperautomation”. Hyperautomation is the new technological phenomenon in which it can bring intelligent automation processes using Robotic Process Automation (RPA), Artificial Intelligence (AI), Machine Learning (ML) and other technologies. It has a good amount of business applications; that is why many tech giants and start-ups are putting huge investments to reap the fruits of Hyperautomation. The data was collected from different secondary sources from 1-4-2020 to 31-7-2021. The rationale of this conceptual manuscript is to explain the definitions, concepts, technologies and models behind Hyperautomation. This study also emphasis in-depth benefits of hyper-automation specifically in Banking & Finance sector. Moreover, the study also presents some of the industry test cases to explain the Hyperautomation adoption level by different countries across the globe.

Keywords: Hyperautomation, Hyper-automation, Intelligent Automation, RPA, Robotic Process Automation.

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INTRODUCTION

With the advancement of technologies, human life has become very simpler than ever before. That is why business tycoons always introduce new technologies, products, services and even new jargons too. In that new jargons line coining, now people are whispering about Hyperautomation across the globe. There is a lot of buzz in tech-industry on the Internet of Things, Big Data Analytics (BDA), Artificial Intelligence (AI), Blockchain technologies, Quantum computing, and Robotic Process Automation (RPA) along with some buzz with its new version-cum-sister technology - Hyperautomation. However, at present a few had spoken about Hyperautomation; the reason it is just begotten; that means just a few years back and currently budding technology like a tortoise walk. Hence, we can find very less publications including research articles, books, book chapters, white papers, and annual reports on this phenomenon. However, some dedicated companies now have started writing blogs, news articles, scribbling short manuscripts, creating short videos, and designing, coding, and developing new technologies relating to Hyperautomation. A few dedicated online webinars, video conferences, software simulated workshops, industry seminars, academic lectures, intellectual doctoral colloquiums and physical exhibitions are set out on this phenomenon. Academicians, researchers, students, and techies have started discussions about Hyperautomation concepts developments. Besides, the industrialists have started investing in a bigger way to capture the upcoming business market including UiPath, Automation Anywhere, blue prism, Pegasystems, workfusion, antworks, KOFAX, Softomotive, datamatics, helps systems, SAP, IBM and so on. Hence, we can find the most demanding automation software in the market like UiPath RPA, Blue Prism, Automation Anywhere– RPA, Laserfiche, Appian, Pega Platform, WinAutomation (Softomotive) and Automate RPA etc.

Moreover, as robotic technology is going to shape the globe for better efficiency and efficacy, some top companies have received funding in 2021 as mentioned by the author Apoorva Komarraju July 17, 2021, and those companies are (1) Real Time Robotics (2) Verve Motion (3) Seoul Robotics (4) Fetch Robotics and among others. Moreover, the new start-ups also getting funds from different stakeholders to enhance the business. Hyperautomation market currently has a market value of US\$4.2 billion and is expected to grow an annual CAGR of 18.9% over the forecast period (2019-2027). By the end of 2027, this market is expected to outperform US\$ 23.7 billion. Hence, we must ensure that the technology developments should grow exponentially with various apps that meet the needs of the current business needs. Hyperautomation involves cutting-edge technologies such as artificial intelligence, machine learning and others to automate business operations, processes, services and thus complement human talent. Hyper-Automaton is a system and model whose main purpose is to augment the WWW with a hypermedia service based on the application of concepts inherent in Computing Science, especially Automata Theory, Category Theory and Hyper documents technology (Machado et al., 2001). On the technological front, Hyper-automation technology is going to serve to be no less than a saviour does in this technological era. Hyperautomation is a strategy intended to automate and transform as many business and IT processes as possible through artificial intelligence and machine learning using a variety of automation tools. In recent years, this definition has changed based on business needs and technological developments.

METHODOLOGY

Methodology is systematic process to investigate solutions. Hyper-automation is a completely new phenomenon; moreover, automation is very old in computers science theory. As already discussed new technology of Hyperautomation and its predecessor technologies, it is clearly understood that it is a contemporary topic or recent development. The public knows a little about Hyperautomation, hence, this sort of research falls under exploratory study. Moreover, most of the connotes available might have a hunch of the experience of the industry people, scientists and researchers. Therefore, as one of the exploratory study physiognomy, data can be collected from secondary sources. Hence, the authors scribbled this manuscript from different secondary sources from 1-4-2020 to 31-7-2021 to collect the data. The secondary sources included google database, google scholar and Web of Science. The main keywords used to fetch the data to scribble the article are not limited to Hyper Automation, Hyperautomation, RPA, AI, ML and others. The secondary online data was in the text, pic, audio and video format. The entire manuscript scribbling went on as a thematic narration based on a thorough reading of research articles, blogs, white papers, and videos. The manuscript is primarily divided into academic literature, technologies, industry applications and cases. The research discovered that Hyper-automation is one of the most ever intelligent technologies that man has invented until now; therefore, it is the need of the hour to work collectively for better operations. Little empirical studies have been conducted up to now, whereas some of the corporates are seriously trying to develop many hyper-automation applications. The next sections will discuss clear academic works on technologies and business cases.

BACKGROUND

The current trend in the IT industry is that of Robotic Process Automation (RPA). RPA is the fastest-growing enterprise software segment in history (Taulli, 2020). This technology has already been embedded in several industry software products. RPA solutions can help enterprises simplify, automate and transform their businesses. Various companies have been successfully using RPA technology as a key enabler to help clients in their digital transformation journey. Nowadays Robots has conquered business processes in back offices (Kroll et al., 2016). Industry clients across sectors have been able to realize tangible benefits with our innovative approach towards smart automation, which include increased productivity, reduced cycle time, improved accuracy, compliance, better service and consequently reduced cost. That means RPA is the next productivity revolution. Thus, the industry thinks that RPA will be another game-changer by improving service quality and thus customer satisfaction. In simple words, RPA involves the use of software that mimics human actions while interacting with applications in a computer and accomplishing rule-based tasks. This often requires reading from and typing, or clicking on existing applications that are used to perform the given tasks (Tripathi, 2018). RPA automation does not require the development of code, nor does it require direct access to the code or database of the applications. However, Robot Operating System (ROS) allows the user to develop packages that are easy to install and highly reusable. Using ROS involves using many different tools aiding in running an environment such as editors, compilers, make systems and package specific tools (Koubâa, 2020).

Table 1. RPA Vendors: Client Market & Source of Revenue

S. No.	Key Vendors	Key Clients	Source of Revenue by Industry
1	Automation Anywhere	Deloitte, Accenture, AT&T, GM, J P Morgan Chase	Banking, Financial Services, and Insurance (BFSI)
2	UiPath	Atos, AXA, BBC, Capgemini, CenturyLink, Cognizant, Middlesea, OpusCapita, and SAP	BFSI, healthcare, telecom and media, and retail
3	Blue Prism	BNY Mellon, RWE npower, and Telefonica O ₂	BFSI, health, and pharmaceuticals, retail and consumer, telecom and media, manufacturing, public sector, travel, and transportation
4	WorkFusion	Thomson Reuters, Infogroup, Citi Bank, and Standard Bank	BFSI sector, followed by the retail and consumer sectors
5	Thoughtonomy	Atos, Fujitsu, CGI, Unite BT, and Business Systems	BFSI, public sector, telecom, healthcare, retail, and consumer sectors
6	KOFAX	Arrow Electronics, Delta Dental of Colorado, Pitt Ohio, Audi	BFSI, retail, consumer, travel, transportation, public sector, manufacturing, and healthcare

Source: Alok Mani Tripathi (2018), Learning Robotic Process Automation, Packet Publishers, Birmingham – Mumbai (India)

A growing market for RPA vendors is experiencing stable and consistent growth. Among the top markets for RPA across the world are the US and the UK. Moreover, the market in Asia Pacific Countries (APAC) is also showing considerable growth for these technological solutions. RPA is in high demand, particularly in industries with large-scale deployment needs. Banks and financial services, healthcare and pharmaceuticals, telecommunications, and retail are the major markets for Robotic Process Automation. Thus, referring to Table 1. Shows example of few RPA vendors, their client market, and source of revenue it can be concluded that RPA will fundamentally change the way we live, work, and interact with one another. Many fortune 500 and global firms are adopting this technology to reap the business benefits including Citi Bank, Fujitsu, Audi, and SAP and so on.

RPA as a technology is still very new and the range of diversity of literature available is not too wide (Doguc, 2020). The issue is connectivity loss, which can be fixed by adding autonomous systems that allow RPAs to safely land of hover (Abid et al., 2014). This led the companies to look for a new innovative solution that is none other than Hyperautomation. The next sections will explore Hyperautomation in the form of an academic literature review.

LITERATURE REVIEW

Father of Hyperautomation: Gartner (Global research and advisory firm)

Year of Hyperautomation Coined: 2019

Alias for Hyperautomation: Intelligent Automation, Digital Process Automation

Definition: Hyperautomation is the advanced technological process for automation of both non/-routine business tasks using advanced intelligent technologies like RPA, AI, ML, and NLP etc. by integrating into a single system for operational efficiency round the clock.

Technologies:

- Robotic Process Automation
- Artificial Intelligence
- Machine Learning
- Natural Language Processing
- Computer Vision
- Optical Character Recognition
- Cognitive Process Automation
- Low-Code Application Platforms
- iBPMS etc...

Programming Languages:

All most all the programming languages can be used to develop different Hyperautomation applications including C, C++, C#, Python, Java, PHP, R, Ruby, Julia, Go and so on.

Advantages:

- Wise technologies in workforce 24/7
- Complete business process automation
- Advanced data analytics
- Instant more accuracy results
- Greater compliance-cum-risk reduction
- Boost employee productivity
- Growth of team collaborations
- Increases the workers knowledge
- Better customer support
- Save operational cost

Nowadays organization have plugged themselves into the digital landscape (Kaelble, 2018). In this digital landscape, we can find many latest technologies including IoT, AI, ML, Blockchain, RPA, and Hyperautomation so on. To be candid there is no firm operational definition on Hyperautomation. However, industry experts defined working definitions through their practical experience and developments on this phenomenon. As the phenomena is yet to flourish, it may takes some time to give proper operational definitions. Hyperautomation is a type of automation that is very essential to the digital transformation, as it removes the human to perform low value tasks and provide data that offers a level of business intelligence that was previously not at all unavailable. The Hyperautomation

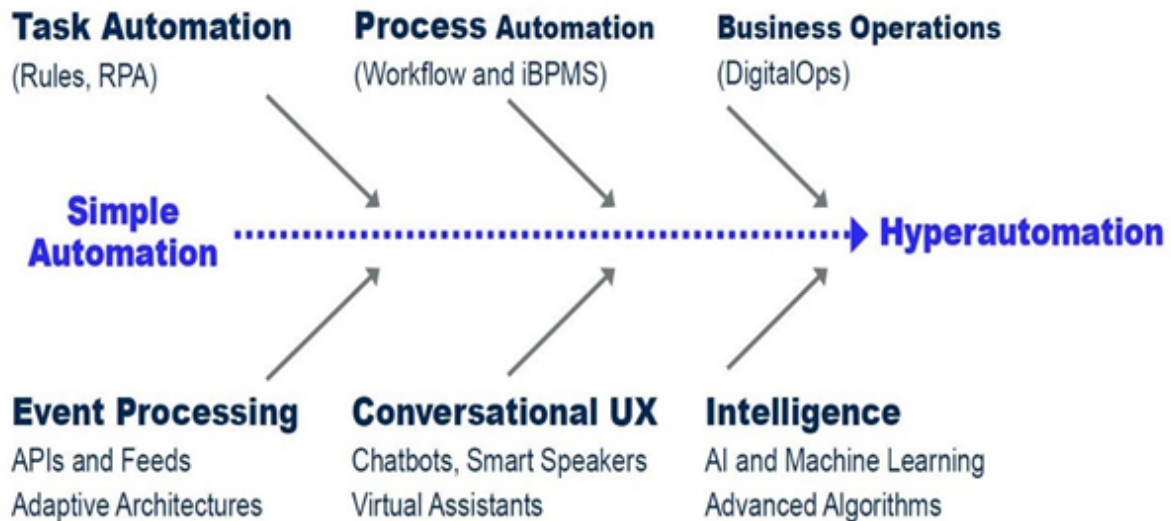
refers to the automation of business processes as workflows, production chains, and marketing processes, etc. Hyperautomation can also be a key factor in building fluid business organisations. That means the practice of Hyperautomation has numerous advantages in firms, both for the operational performance and well-being of an organisation.

Some of the academicians and researchers defined (working) that Hyperautomation is a huge collection of machines, software packages and automation tools for delivering work (Chen, 2021). Authors, Lasso-Rodriguez & Winkler (2020) also conceptually defined based on hunch that the Hyperautomation happens to be a recent technological term (phenomena), which involves automation of knowledge work with a broad business scope and technologies integrated with a responsive workforce, mostly combining RPA with ML and/or further AI functionalities. It combines methods and technologies to execute business processes automatically on behalf of knowledge workers (Bornet, et al., 2021). With the incorporation of automation technologies and intelligence, not only human capabilities are augmented, but automation also extends to more sophisticated and complex tasks. Hyperautomation (Hyper automation) can be used to orchestrate greater agility in all business process. However, for better understanding another author defined that Hyperautomation is a set of communicating processes, which reflects openness, event-driven nature, cyclicity, synchronism, and very logical parallelism of a control algorithm (Zyubin, 2007).

Hyperautomation is revealing the true capability of software robots when combined with multiple tools and techniques. It shall not be surprising to hear soon about brave businesses trusting more on self-reliant robots with AI to take over expert professional work and higher responsibilities (Lasso-Rodriguez & Winkler, 2020). Moreover, Hyper-automation can significantly reduce production costs, and with the use of advanced digital technologies (Остроух & Колбасин, 2020). Hyperautomation is associated with all stages of automation itself (detection, analysis, design, automation, measurement (Остроух & Колбасин, 2020). In late 2017, Wipro, referred to Hyperautomation projects at the time, as a cognitive service offering to their customers, which combines RPA and AI for process automation (Tarafdar & Beath, 2018). Automation is the use of technology to handle processes or conduct operations with minimal interaction. Automation and advanced intelligence technologies can combine to enhance the user experience and customer satisfaction due to use of software robots across core processes in the enterprise. When grouping robotics, CNC, and PLCs under a collective banner, one should highlight what these technologies have in common- namely, “programmability.” Therefore, these technologies are collectively named “programmable automation technologies” (Kandray, 2010). Hyper-Automation has become a reality (Stoudt-Hansen et al. 2019). The goal of Hyperautomation is not to replace humans; it is to make humans more efficient and capable. Hyperautomation benefits in organisational repetitive tasks to free up workforce and allow them into sharpen their focus on revenue-generated tasks. Intelligent Automation (IA), also called Hyperautomation, is a concept leveraging a new generation of software-based automation. It combines methods and technologies to execute business processes automatically on behalf of knowledge workers (Bornet et al., 2021). Of course, connecting to the Internet is also a key component of Hyperautomation. There is no field left without Hyperautomation application including accounting, banking and finance, insurance, human resources, manufacturing, production, real estate, marketing, call centres, education, research etc. The next section will sight see in detail frameworks of the Hyperautomation.

Automation-(2)-Hyperautomation: Gartner

The Path to Hyperautomation



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Gartner

Figure 1. Path to Hyperautomation

Source: <https://appian.com/resources/learn/what-is-hyperautomation.html>

Hyperautomation is an advanced version of automation followed by Robotic Process Automation. If researchers really trace back to the genesis of Hyperautomation, as per Gartner's report, toured from simple automation to today's advanced intelligent Hyperautomation. Initially, the business organisations developed Task Automation in which event processing used to take place with the help of software. In this automation, rules were defined very clearly and dedicated tasks were used. In this type of automation, it is necessary to stocks possesses of Application Process Interface (API) and feeds plus adaptive architectures. The Best example is Robotic Process Automation. Then the second one is Process Automation, which possesses completely workflow in business processes and is carried out by software. That means Conversational UX applications come under this category. For example, smart speakers like Apple's Siri and Amazon's Alexa and Microsoft's Cortana chatbots come under this category. Moreover, virtual assistants and chatbots also fall into Process Automation. The next stage is Business Operations; irrespective of human resources, marketing & sales, accounting & finance, manufacturing, project, production and operations management in which intelligence is base for carrying of the whole process efficiently. Figure 1. is clearly depicted how the Hyperautotion technology is developed over a period. Gartner (Research & Consulting) developed this model through their empirical research over a period.

Could Hyperautomation be a name for AI plus RPA? Marzieh N.

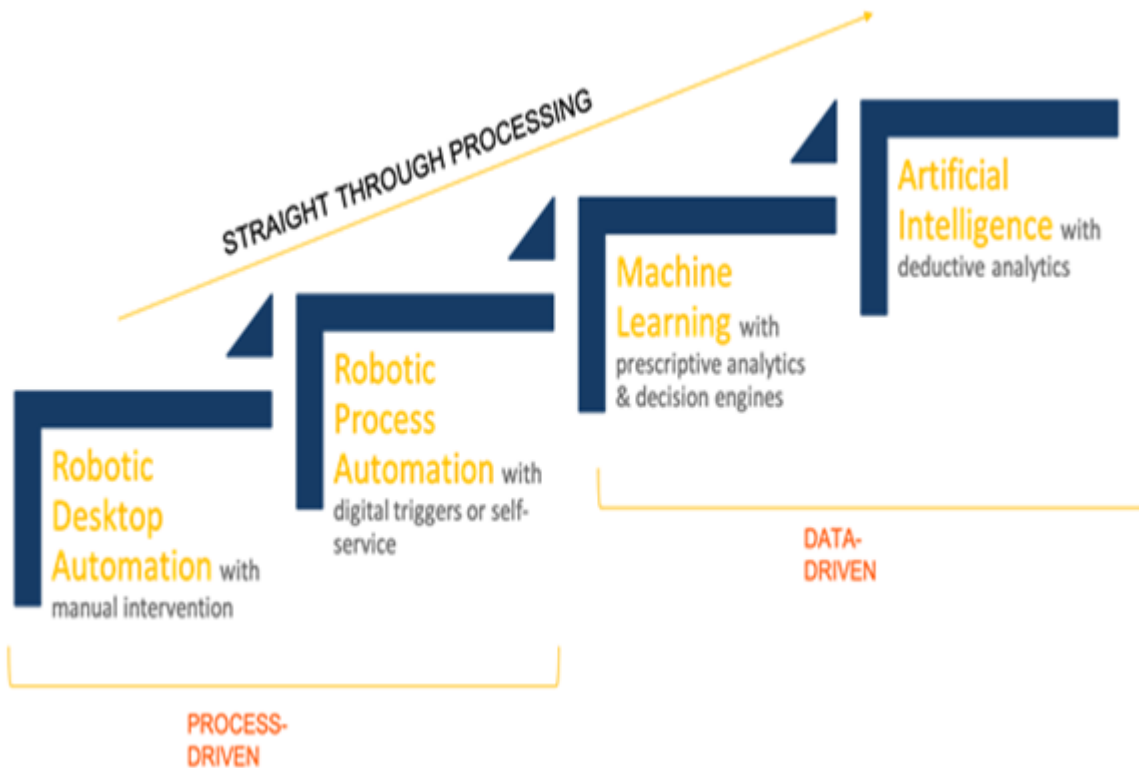


Figure 2. Could Hyperautomation be a name for AI plus RPA?

Source: <https://www.automationanywhere.com/company/blog/rpa-thought-leadership/could-hyperautomation-be-a-name-for-ai-plus-rpa>

While many researchers across globe have already confirmed that Hyperautomation technology is nothing but an amalgamation of RPA, AI, ML and other intelligent sister technologies to automate complex tasks. In Figure 2. Author (Marzieh Nabi, 2020) also defined in a different way that hyper-automation can be a name for AI plus RPA? The answer is yes as per the author. As per the author's opinion: the automation process is divided into two categories; **Process-Driven Automation** in which again sub categorised into (a) Robotic Desktop Automation: the automation process takes place at the desktop level only with some manual interventions (b) Robotic Process Automation: this is the next version of Robotic Desktop Automation. In this, type of automation self - services facility is available round the clock with the help of digital triggers, which are pre-programmed. The second category is **Data-Driven Automation** in which it is again classified into (a) Machine Learning and (b) Artificial Intelligence. According to author, Machine Learning, dependent automation brings the predictive analytics and decision engines to take better decisions in different business environments and finally lead to managers to take the right decision at right time at the right place for business profits and growth. Presently, there is a lot of demand in the market in many business sectors. Moreover, Artificial Intelligence is the next-cum-current automation process. This process brings deductive analytics. A theory-driven deductive approach begins with a theory either something new and original or one that has already received research attention in the scientific literature (McIver, et al., 2018). Thus, it can be concluded that Hyperautomation is a collection of RPA and AI.

Sophistication of the Automation

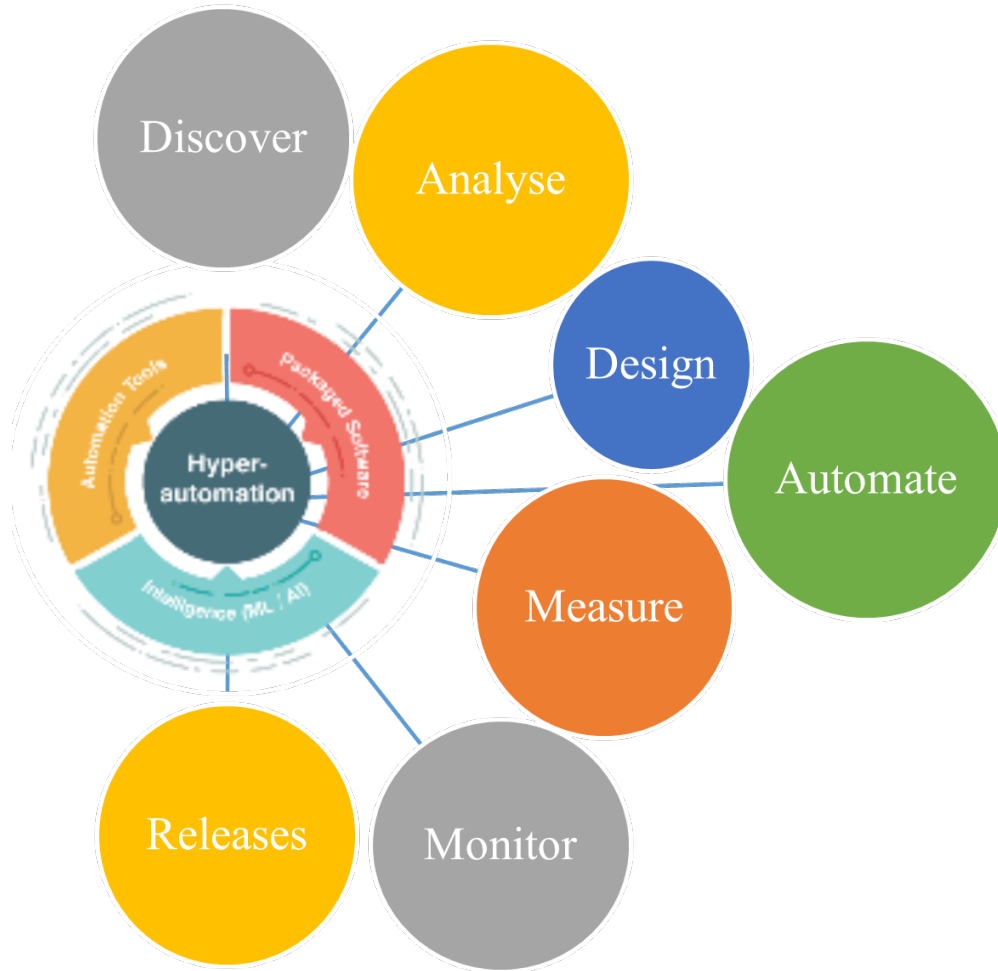


Figure 3. Sophistication of the automation

Source: <https://www.xcubelabs.com/blog/hyperautomation-and-its-role-in-digital-transformation-across-industries/>

In the blog “Hyperautomation and its Role in Digital Transformation across Industries” by [x]cube LABS which is published on December 01, 2020, refers to the sophistication of the Hyperautomation, such as **(1) Discover:** Discovering the connecting objects, devices, people, organisations and processes in the concerned environments take place as the initial process **(2) Analyse:** With the help of high capacity and intelligent algorithms the current situations of business situations are analysed efficiently **(3) Design:** With the help of supervised, unsupervised, semi-supervised and reinforcement learning techniques, the many models will be planned and designed based on the data learning **(4) Automate:** Choosing the best model to process the best results for complete automation round the clock **(5) Measure:** Trying to find more accuracy of the model by comparing models among different accuracy techniques **(6) Monitor:** Monitoring the entire process right from the process started and the training, testing and validate results and make sure to get the best outcomes **(7) Releases:** The last stage but not the least is the Hyperautomation is releasing the more reliable and high-efficiency models in the market for transfer learning for larger societies use. Moreover, the authors also state that Hyperautomation use many advanced technologies by integrating Robotic Process Automation,

Artificial Intelligence, Intelligent Process Discovery, Intelligent Document Processing, and Advanced Analytics, and the Digital Operational Tools and so on. The right tool and technology are crucial in Hyperautomation, so it is important to use the right tool. Decisions regarding these tools depend on the organization's strategy, its decision-makers and teams, as well as their skills. The next section will explore the hyper-automation process.

Hyperautomation Process Flow

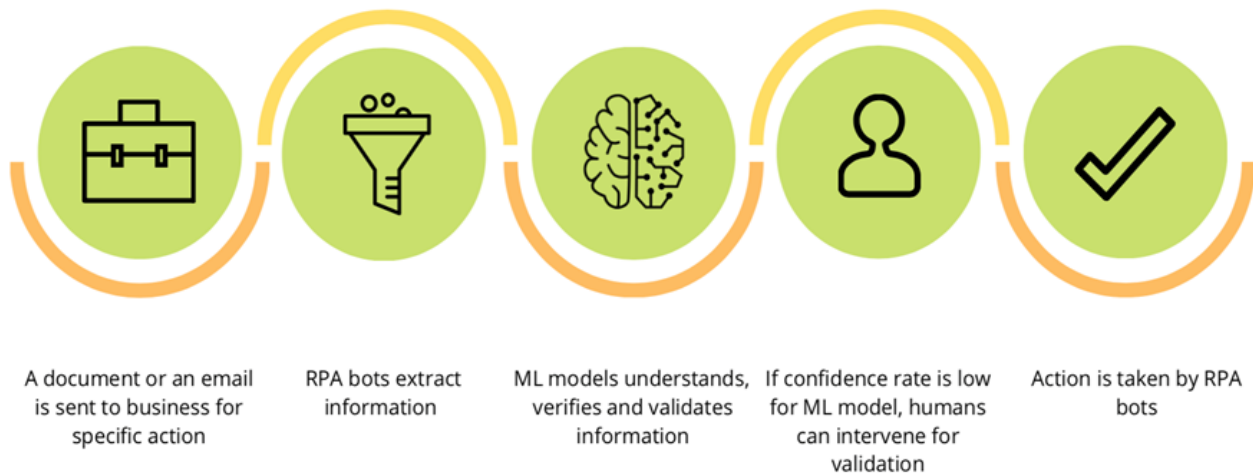


Figure 4. Hyperautomation Process Flow (Document Based Process)

Source: AI Multiples: <https://research.aimultiple.com/hyperautomation-examples/>

Now the question is how does exactly Hyperautomation technology work? As per the author Cem Dilmegani (July 5, 2021), Hyperautomation process flow framework that works for all industries is depicted in Figure 4. As per the notion of Cem Dilmegani (1) Robotic Process Automation bots collect incoming emails and documents. Depending on the nature of the data, these emails or documents can be structured, semi-structured, or unstructured (2) A machine-learning model extracts machine-readable information from emails or documents (3) After that Machine Learning model or rules used to validate machine-readable data (4) Database lookups or machine learning models enhance validated data (5) Using human-in-the-loop software, the output can be reviewed by a human if the machine-learning model confidence level is low (5) This validated and enriched machine-readable data is then passed to the next system of record. Accounts payable and accounts receivables, travel and expenses, purchase order management, customer service operations, anti-money laundering and lead generation from anonymous site visitors are the best examples for hyper-automation.

Quixy - A Platform for Hyperautomation Powered by No-Code: Quixy helps you get started with no-code automation for hyper-automation. The Quixy High-Performance Application Platform as a Service (hpaPaaS) helps enterprises build complex custom software applications faster, with higher quality and at lower costs. With Quixy, organisations improve organization's flexibility and agility to handle changing business requirements. As per Quixy, the important technologies are depicted in the adjacent section.

Technologies

Gartner coined the term hyper-automation. The consultancy Gartner believes that hyper-automation will have the greatest impact in the coming years. Hyperautomation is the application of RPA, process mining, machine learning and other technologies that are applied to enhance automation and digital transformation in organisations. In 2020, the most important technology trend according to Gartner is hyper-automation, refers to the totality of automation efforts across an entire organization and is tightly coupled to industry 4.0 (Jacoby & Usländer, 2020). Hyperautomation is moving from fixed automation to perception-based processes. RPA augmented with AI and ML becomes the core enabling technology of hyper-automation (Srivastava, et al, 2020). The same is can be supported by different authors in a different way that Hyperautomation is the combination of technologies that allow faster application authorship (like low-code and no-code) with automation technologies that coordinate different worker types (i.e. human and artificial) for intelligent and strategic workflow optimization (Calkins et al., 2020). However, AI, big data, and robotics can contribute to developing hyper-automation that can increase productivity and intensify industrial production (Park, 2018). The potential value of data follows a similar exponential trajectory as Machine Learning and Artificial Intelligence drives hyper-automation and augmentation of operations and interactions (Robertson & Parsons, 2017). From this, it is understood that Hyperautomation is a mixture of few technologies like IoT. These technologies are explained in the next section.

Robotics Process Automation (RPA)

The pre-version of Hyperautomation is Robotics Process Automation. In the business there, are many processes across industry repetitive tasks in which labour is not required continuously, which may cost high for the company and the wastage of human intelligence in the repetitive tasks. Hence, companies like UiPath, Blue Prism, Automation Anywhere, Laserfiche, Appian, Pega Platform, and WinAutomation so on pioneered different RPA solutions in which routine tasks can be handled by software. This technological solution led many companies to adopt in their business process and making the operations efficiently. There are many testimonials domains like call centres, insurance, banking, finance & accounting, IT&ITeS companies, where RPA is rapidly embracing. Robotic Process Automation can bring immediate value to the core business processes including employee payroll, employee status changes, and new hire recruitment and on boarding accounts receivable and payable; invoice processing, inventory management, report creation, software installations, data migration, and vendor on boarding etc. to name a few applications (Madakam et al., 2019). The basic benefits of this technology will be operational efficiency and effectiveness. Human intelligence can be used for new product solutions. The errors will be reduced with the help of standardised solutions for probably queries rising by different clients at the time of technical clarifications. The text and speech chatbots usage in mobile payment systems by telecom, media and mass communications are good examples of RPA. This is the base technology for hyper-automation. That is why within digital transformation, which is continuously progressing; robotic process automation (RPA) is drawing much corporate attention (Hofmann et al., 2020).

Artificial Intelligence (AI)

Currently, Artificial Intelligence (AI) has integrated into our daily life as well as professional life like never before. AI is another old technology but got a lot of attention in the last decade due to the industry taking interest in new developments, humongous data generated from different sources, availability of high computational power nowadays and increase AI applications in our day-to-day life. The AI history re-roots back to the Alan Turing machines and John McCarty's white papers dated in 1955. Slowly 1980 became the base for AI; as the Year of Artificial Intelligence.

However, the actual and more scientific works started from 2000 onwards. That is why John McCarty is treated as the father of AI. AI technology is the electronic device mimic of human intelligence. Scientists initially designed electronic machines for assisting human works for their comfortable life by thinking process as a human being, seeing, hearing, sensing and finally act like a human being. Currently, we are using weak AI applications, where AI can do dedicated tasks like speck recognition, text translations, financial bots and self-driving cars to name a few. Moreover, the scientist believes that in the coming year years, we will be embracing General AI applications in our surroundings, in which AI technology intelligence power is on par with a human being and they are part of our daily life in the fort coming virtual-cum-real-time environments. However, some scientists believing that the next level of General A which is nothing but Super AI; will have more intelligence power than human beings and may be dangerous to human survival on the earth apart from societal usage. Hence, many tech companies not only developing Weak, General and Super AI technologies and applications but also concentrating on the development of responsible AI; which is nothing but ethical AI for a harmonious human life with robots in the days to come.

Machine Language (ML)

Machine Learning has been a focus of artificial intelligence since the beginnings of AI in the 1950s (Shavlik et al., 1990). A lot of debate is going on among academicians, researchers, techies and tech-giants about new machine learning developments of designing, algorithms, libraries, packages, and applications using various languages like python, Julia, JavaScript, C, C# and many more high level language. Besides, corporates are investing funds in a bigger way to capture the new business opportunities in ML related software developments. Machine learning addresses the question of how to build computers that improve automatically through experience. It is one of today's most rapidly growing technical fields, lying at the intersection of computer science and statistics, and at the core of artificial intelligence and data science (Jordan, & Mitchell, 2015). That means Machine learning is an evolving branch of computational algorithms that are designed to emulate human intelligence by learning from the surrounding environment (El Naqa & Murphy, 2015). Machine Learning (ML) is one of the AI sub technologies. Currently, many IT/ITes industry techies are continuously putting software engineering requirement analysis, designing, coding, developing and testing new packages for business applications. The beauty of this technology is that the machines will get intelligence ability by learning from data sets with the help of algorithms written by programmers along with subject experts. Different programming languages among using for licensed and open source packages. At present, there are many algorithms available in the public space for different machine leaning techniques including supervised, unsupervised, semi - supervised and reinforced supervised.

Optical Character Recognition (OCR)

Many researchers across the world are going on in this field of OCR for the last few decades and many articles have been published in this field. Optical character recognition is essential for translating pixel-based images into searchable and editable text formats. Many Artificial Neural Network models (ANNs) have been proposed to mimic the human brain in solving problems involving human-like intelligence. An application of an artificial neural network approach for optical character recognition (Mani, & Srinivasan, 1997). It is defined as the process of digitizing a document image into its constituent characters (Islam et al., 2017). Optical Character Recognition is the process of classification of optical patterns contained in a digital image. Character recognition is achieved through segmentation, feature extraction and classification (Chaudhuri et al., 2017). That means the Optical Character Recognition process involves recognizing and classifying characters from an image. The OCR improve human - machine (H-2-M) interaction efficiently.

Language Understanding Intelligent Service (LUIS)

Language is the base platform form for everybody to express our feelings and opinions to fulfil our wants and needs to second person and/or group of people. In general, every person has his /her own mother tongue or learned multiple tongues through soundings or traditional education system. As globalisation taking place exponentially for the decades, the need of conversation among different countries and several dialogues is also inevitable. Hence, many software developers are continuously working (coding) using high level programming languages to translate from language to another language or else many other languages using complex mathematical algorithms. This recent phenomenon is called Natural Language Processing or Language Understanding Intelligent Service (LUIS) in tech-world. LUIS is an NLU system that we have used extensively and is a good learning tool for us to apply the important concepts of intent classification and entity extraction (Rozga, 2018). That means LUIS is a natural Language processing Artificial Intelligence for predicting human queries (Banu & Patil, 2020). Hyperautomation technology is often used in NLP applications. NLP is an area of research and application that explores how computers can be used to understand and manipulate natural language text or speech to do useful things (Chowdhury, 2003). One best example for machine learning applications is chatbot. The beauty of this technology is it give same meaning for the source language text. The exact translation can be from text to speech or speech to text and from any language to any language. A chatbot is computer program that uses natural language processing to converse with human using text to speech in real time.

Hyperautomation Technological Ecosystem

As per the authors; George Lawton and Corinne Bernstein in their blog “**Hyperautomation**” as shown in the Figure 5. explored that Hyperautomation technological ecosystem divided into is three categories. **Discovering Automation Opportunities:** These are technologies for identifying and prioritising the automation processes. That means the primary technologies that are required at the initial stage of finding out automation opportunities. The discovering automation opportunities technologies include but are not limited to (1) Process Mining:

1. Task Mining
2. Process Analytics

Implementing Automation: The second category of technologies is meant for reducing the effort and cost of building automation at different firms’ levels. These technologies include

- Robotic Process Automation (RPA)
- no-code/low-code
- Platform as a Services (SaaS)
- Workload Automation
- Business Logic Tools
 - a. intelligent Business Process Management Suites (iBPMS)
 - b. Decision Management
 - c. Business Rules Management

Extended Automation with AI: The third category includes AI technologies for extending automation capabilities:

1. Machine Learning
2. Natural Language Processing
3. Optical Character Recognition
4. Machine Vision
5. Virtual Agents
6. Chatbots
- 7.

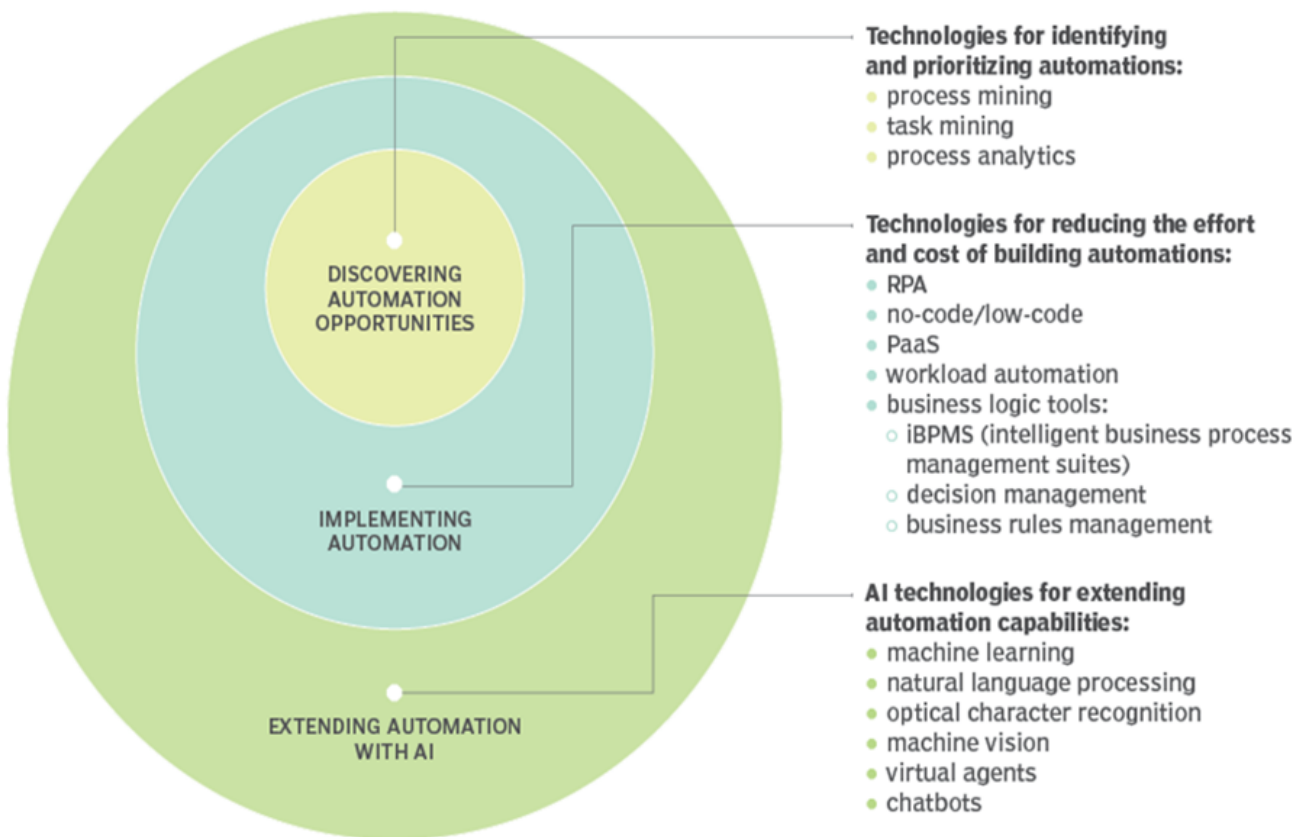


Figure 5. Ecosystem of Hyperautomation Technologies
 Source: <https://searchcio.techtarget.com/definition/hyperautomation>

Banking & Finance Applications

Hyperautomation; RPA with the inclusion of artificial intelligence and machine learning, is transforming the world to experience new technological advantage. It is widely known in the society that application of hyper-automation is at the initial phase. Many practitioners say that it requires few more industrial revolutions to see the robots adapting intelligence skills in a bigger way. However, on

the other side, some organizations are processing the businesses with the help of hyper-automation. Hyperautomation, i.e. machines' ability to think and process independently, is limited to the manufacturing or packaging, insurance, or health sector. Still, even its application is widely adopted in the financial industry. Let us discuss some use cases of automation in the banking and finance sector. Robotic Process Automation is gaining heavy interest from the big players. It is helping to cope with many challenges in the business process and plays a key role in making informed decisions. The banking and finance industry generates sets of loans, deposits and many other financial parameters. Human errors in manual data analysis acting as big hurdles in financial organizations. With robotic process automation, the industry is experiencing a high reduction in cost in terms of consultations. Some key areas where the industry can experience a drastic change in serving its customers using hyper-automation are:

Lending Operations

Banks generally have to process many documents in loan lending. Either it is for retail lending or commercial lending, banks deal with heavy paperwork. Robotic process automation helps the banks to assess the loan documents and provides insightful decisions. This also allows the banks from the earlier hurdles like human errors and help to reduce the cost incurred on employees. JP Morgan uses robotic process automation in analysing its loan and contract agreements. The platform named COIN, used by JP Morgan, consists of power bots made up of artificial intelligence analyses extensive data set, including loan agreements, credit scores, and other important financial measures. This hyper-automation provides many benefits in decision-making regarding the investment pattern, cash inflow etc. This also helps banks for a smooth and efficient business operation with ready information anywhere and anytime.

Marketing

With the changing technological environment, marketing plays a crucial role in taking out the products to the customer. Response emails and other product-related information via human intervention is time-consuming and not cost-efficient. With hyper-automated software, the banks send the customised or tailor-made products directly to the targets groups with less time. The response time for the queries is also gets reduced. The software can assess the interests of customers based on their product requirements. Chatbots helps banks to identify the data pattern of customer's intentions in purchasing the product.

Sales and Distribution

In addition, with the vital information on hand, banks can easily convert the good proportion into target groups. Boston consulting group says that banks will experience a crucial change in delivery and distribution models in the near future. With the heavy adoption rate in digital channels, banks are trying to cut down the branch services and focus on serving the customers through digital channels. App provides all one catalogue to experience the banking digitally.

Regulatory Reporting

With the adoption of robotic process automation, banks can process the information 24 /7. This also helps banks to reduce the complexity in regulatory reporting with in the banks. Robotic process automation is helped to understand and solve the severe complexities in the data and understand the pattern in data. This allows banks to experience transparent reporting due to fewer human errors. Along with all uses cases, many other segments are transforming at a fast pace with hyper-automation. In addition, hyper-automation helps to control and reduce corruption by identifying the pattern in transactions. All these are the crucial segment where hyper-automation is changed and will continue to change the face of the banking industry. The next section is sightseeing the two case studies in banking applications.

ICICI Bank

ICICI (Industrial Credit and Investment Corporation of India) is a widely known banking company globally. As a banking company, ICICI has many services offered to its customers. From the initial stage where a customer opens their bank account, deposits, withdrawals, the loan process and investments, this company has a wide range of operations through its branches located across the world. ICICI uses software robots to trace the currency movements in and out and identify the business process patterns. The application of these software robots helps to identify and explain the interconnection between the transactions in different segments. Now ICICI uses this software robot in managing human resources and applying to get informed decisions on agriculture and retail services. This bank also implemented robotic arms customized to sort out the currency notes and further manage the note-sorting units. These robotic arms, which are connected to high-end sensors, check the correctness and accuracy of notes and further decide whether they are issuable or non - issuable. ICICI uses these robotic arms at its currency chests located in different regions. Besides, in India, this bank is well known for its implementation of Blockchain transactions in its business.

Apart from the application of robotics in banks internal mechanisms, ICICI also implemented robotics in the retail end. In the contemporary world, technology has made bank customer transactions very easy, and with the rapid penetration of mobiles with a single click, one can execute the transaction. ICICI has gone further in doing this by enabling the software's with voice assist commands. Consumers can perform the transactions with their voice, and the bank has utilized Apple's Siri voice assistant in enabling this service. Moreover, this bank has provided the locker services with very minimum human intervention and the service is named '**Smart Vault**'. Smart Vault has a robotic arm that closes ad opens the vault with the help of advanced radiofrequency waves. ICICI also implemented the use of AI in providing information to customers regarding investments (Aratrika, 2021). It launched Mobile coach, an application that is coded with the robotic algorithm. This serves the customer initial paperwork in opening a Demat account with a single click to suggest the best and good performing mutual fund. ICICI has focused on developing its software infrastructure aligning with machine learning and artificial intelligence to run and perform its business better and efficiently. It enabled the use of hyper-automation for better internal decision-making and transformed the way it operates in servicing the customers. However, the efficiency and productivity with the adoption of hyper automated tools and techniques are not widely measured either qualitatively or quantitatively, this adoption is actually changing the way the organisations operate the business for operational efficiency

Softbank

Softbank, which is headquartered in Japan, is very famous in the banking and finance industry. It is well known for its heavy investments in various sectors all over the globe. Soft bank's robotic division named soft bank robotic group is a subsidiary of the soft bank. Softbank robotics group has revolutionised the robotic manufacturing industry. The two humanoid robots with the name Nao and Pepper are popular in many countries. Humanoid robots can understand how people feel and are responding to them. Algorithms used in these humanoid robots are compelling and efficient. Most of these sales are in Japan and further hotels are very enthusiastic about using these robots for better customer service. However, Softbank is now concentrating on generating more revenue by manufacturing robots for commercial use (Steve, 2021). Most of the companies in the manufacturing sector are processing the work using robots. Especially in car manufacturing units, robotic arms are widely adopted for better and efficient manufacturing. Softbank's robots are not available in many countries, but it comes with a high price even if available. To cope with this issue, the soft bank robotic group is tying up with the local robot manufacturing companies to tap the potential of the robotic market. Softbank also manufactured a robot for floor cleaning and named it 'Whiz', which helped the companies when the two humanoid robots sales lag. In future, Softbank robotic group is trying to strengthen the company's profit by investing in robots.

CONCLUSIONS

Even though the Hyperautomation phenomena has ocean applications and is becoming part of business activities as well as our daily life, there needs to be collaborative work carried out by all stakeholders; academicians, researchers, students, industry giants, consultants. More importantly, bureaucratic support is required in each country. This plays a crucial role in developing new products, applications for increasing the quality of services useful for human life. Thus, many new start-ups are also setting out their business using this phenomenon along with established multinational companies like Microsoft, IBM, SAP, Capgemini and Infosys and Wipro to name a few. Of course, the well-known in this niche market are Uipath, Automation Anywhere, blue prism, Pegasystems, workfusion, antworks, KOFAX and so on. Therefore, it is the need of the hour that all stakeholders should also adopt these technological fruits in a bigger way for our better life. Stakeholders need to wait for complete Hyperautomation for future Quality of Life in their daily life.

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