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ICT in Business and the Public Sector

Navigating the Hyperautomation Journey: A Comprehensive Model for Assessing Hyperautomation Maturity

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MASTER'S THESIS

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Abstract:

Background:

With the advent of Industry 4.0, many industries have digitized their operations, leading toward a more data-driven, connected, and technology-centric business environment. This has increased the demand for automation and hyperautomation solutions as organizations aim to meet customer needs, cut costs and compete more effectively. However, organizations find it difficult to effectively address the driving forces during their hyperautomation journey and scale their programs organization-wide due to the ambiguity in the scope of the work involved.

Aim:

This research aims to assist organizations by presenting a comprehensive Hyperautomation Maturity Model encompassing automation maturity stages, success factors, and challenges that must be considered to mature with hyperautomation implementations for maximizing its value. By pinpointing such determinants, this paper offers a systematic approach to navigating the complex landscape of automation implementation.

Method:

Employing the design science research (DSR) paradigm, the study utilizes a combination of literature review, expert interviews, and document analysis to build the Hyperautomation Maturity Model. Thematic analysis is applied to identify common themes and patterns in expert responses and document analysis results, ensuring a robust understanding of the key factors involved in implementing and scaling hyperautomation. After the design of the model, its utility has been questioned through interviews by presenting the model to the experts and making conclusions from their judgment.

Results:

The research culminates in development of the Hyperautomation Maturity Model which describes the maturity levels, dimensions, and guidance for organizations to implement and scale their hyperautomation capabilities organization-wide. The model is evaluated and validated through expert interviews and feedback, proving its utility and applicability in real-world scenarios. Moreover, the study delivers data collected through interviews with experts in the field, along with an analysis of the results.

Conclusion:

The research contributes significantly to the understanding of hyperautomation and automation maturity by developing a model that can guide organizations in scaling their automation capabilities. The study emphasizes the importance of comprehending hyperautomation technologies, stages of implementation, and organizational factors that influence successful hyperautomation implementation.

Acknowledgments

I am grateful to have embarked on this academic journey, and I would like to thank the people who have guided, supported, and inspired me along the way. The completion of this thesis would not have been possible without their invaluable contributions, and it is my pleasure to express my gratitude to them in this acknowledgment.

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I could not have undertaken this journey without Roel Hoeks and the RoboRana Group. Roel especially has been a driving force throughout my research journey. Through his initiatives, I was able to access experts in the field of automation and found the opportunity to conduct interviews. He paved the way for more comprehensive research. He has consistently supplied insights, which has significantly broadened my perception and understanding of hyperautomation. He has not only contributed to the quality of my research but also deepened my understanding of the realities and complexities of the automation world.

Special thanks to Tyron Offerman, my second thesis supervisor, for his support and guidance in developing the model and analysis of the interviews. His recommendations greatly enriched the quality of the research.

Thank you all.

Berkay Koralturk

Table of Contents:

1. Introduction

This chapter introduces our research by first discussing the background and context, followed by the research problem, the research aims, objectives, and questions, and lastly the outline of the thesis.

1.1. Background and context

Hyperautomation a term coined by IT firm Gartner in a 2019 report, is defined as a business-driven approach organizations follow to strategically automate as many business processes as possible (Ray, Guttridge, Vincent, & Karamouzis, 2021). It uses a combination of multiple technologies, such as artificial intelligence (AI), machine learning (ML), RPA, no-code/low-code development tools, etc., to create a framework that expands automation capabilities (Ray, Guttridge, Vincent, & Karamouzis, 2021).

There has always been a demand for automation among different industries, but today this demand is increasing exponentially. According to research (Madakam, Holmukhe, & Revulagadda, 2020), the hyperautomation market in 2020 had a market value of US$4.2 billion and was expected to grow an annual CAGR of 18.9% over the forecast period (2019-2027). According to market research done in March 2023 (Polaris Market Research, 2023), currently, this trend of growth is continuing as the market value for hyperautomation has reached a value of US$42.45 billion. By 2027 the hyperautomation market is expected to reach $319.9 billion (Kavas, Ike, 2022).

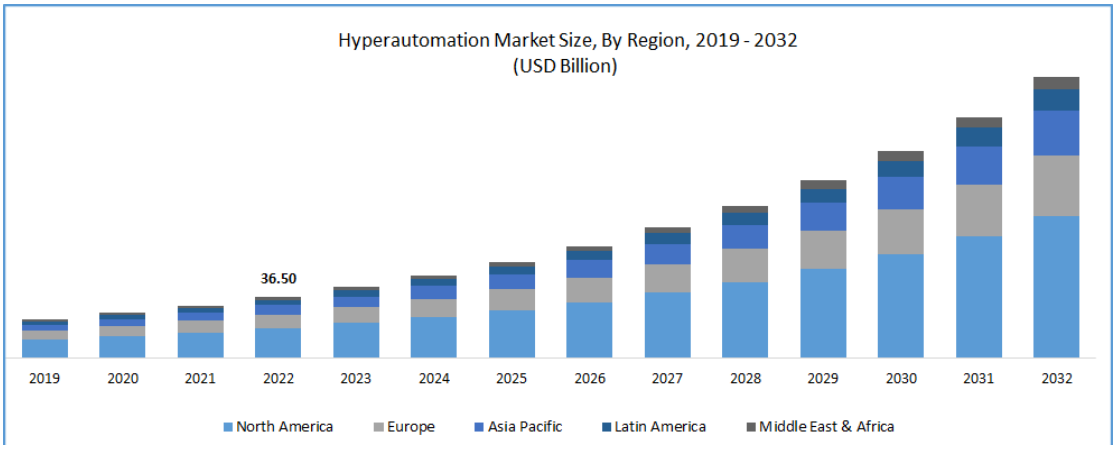

Figure 1: Hyperautomation Market Size By Region, 2019-2032 (by Polaris Market Research, 2023)

1.2. Research problem

Organizations seeking to drive top-line growth or bottom-line performance by implementing automation at scale led to the emergence of the approach hyperautomation, but organizations struggle with the implementation and scaling of hyperautomation due to the complexity of involved work, lack of understanding of the technology landscape, and absence of a clear roadmap. Without a proper plan, hyperautomation initiatives can become disjointed and fail to deliver the desired

outcomes, leaving organizations with a significant investment in technology but no tangible benefits.

Companies struggling to find the right approach to implement automation further in their organization is a recurring problem, as highlighted in numerous reports (Bhatt, Nihit;, 2019; Edlich, Alex; Phalin, Greg; Jogani, Rahil; Kaniyar, Sanjay, 2019; Richard Bergman, 2021; Suresh Sambandam, 2021). According to a paper published by McKinsey Digital (Edlich, Alex; Phalin, Greg; Jogani, Rahil; Kaniyar, Sanjay, 2019) and Ernst & Young (Bhatt, Nihit;, 2019), 30%-50% of all Automation and AI implementations fail for several reasons. A recent qualitative study from Turbotic shows that midsize and large companies are facing the same challenge (Richard Bergman, 2021).

Once organizations begin using RPA, Low-code/No-code, OCR, NLP, AI, or other transformative technologies and see the offered value, they want to expand their use and scale (Richard Bergman, 2021). Generally, companies start with a POC or a pilot setup to prove the technologies's feasibility to start their journey. Later on, companies try to scale by increasing their number of robots, AI models, and solutions on an insufficient infrastructure (Richard Bergman, 2021). While initially expanding the use of automation technologies can boost overall efficiency for a short time, companies often face limitations as they try to scale on an insufficient infrastructure. Which results in step backs, extra costs, and the need for highly manual tasks to carry out hyperautomation.

There are lots of principles given to implement Automation and AI capabilities such as the Plan-Do-Check-Act Procedure, Robotic Process Automation Development Life Cycle, BPM lifecycle, The OECD AI Principles, and other procedures given by different companies and researchers. Figure 1 shows the steps given by the leading RPA provider, UiPath (Vargha Moayed).

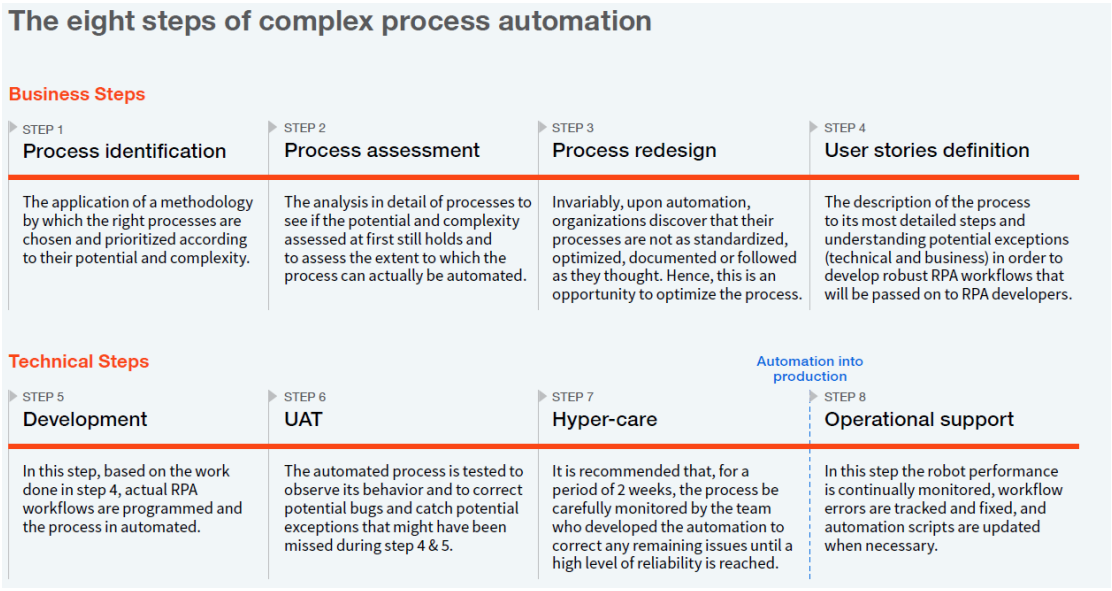

Figure 2: Eight Steps of Process Automation by UiPath

Although these steps are pretty standardized and applicable to almost every case, we think that they fail to provide details on how an organization can grow further while following these business steps.

1.3. Research aim and objectives

The primary aim of this research is to design a model that will determine a company's current maturity level in hyperautomation and guide organizations to reach the next levels by identifying stages and key dimensions in scaling automation.

1.4. Research questions

This research study examines determinants of hyperautomation maturity and the effective scaling of automation capabilities. The following research questions are formulated accordingly and will be answered throughout the paper.

Research Questions:

Q1 – What is hyperautomation?

Q1.1 – What are the common definitions?

Q1.2 – What business goals do organizations try to achieve with the use of hyperautomation?

Q1.3 – What are the most common technologies?

Q2. – What are the stages of a hyperautomation implementation?

Q3 – What are the dimensions that organizations need to mature to scale their hyperautomation capabilities?

1.5. Research outline

By following the below structure, the paper will comprehensively address the research aims, objectives, and questions. Contributing to both academia and real-life practices in the domain of hyperautomation and automation maturity.

Chapter 1: Introduction - This chapter introduces the research by discussing the background and context, the research problem, aims, objectives, and questions, and lastly the outline of the thesis.

Chapter 2: Literature Review - This chapter presents a review of the relevant literature on hyperautomation, the benefits of hyperautomation, the technologies involved, stages of implementation, and existing models related to automation maturity.

Chapter 3: Methodology - This chapter describes the research approach and methods used in the paper, including the design science research (DSR) paradigm,

data collection through literature review, expert interviews, and the data analysis process.

Chapter 4: Interview Methodology and Results - This chapter describes the methodology we used in the exploratory interviews and the gathered insights.

Chapter 5: Hyperautomation Maturity Model - This chapter details the development of the model, describing the maturity stages, dimensions, and guidance for organizations to implement and scale their hyperautomation capabilities.

Chapter 6: Model Evaluation - This chapter presents the evaluation and validation of the developed model, via expert interviews and feedback. Proving its utility and applicability in real-world scenarios.

Chapter 7: Discussion - This chapter presents the threats and limitations faced while conducting the research and the potential impacts it will have.

Chapter 8: Conclusion and Future Research - This chapter concludes the thesis by summarizing answers to the research questions, discussing the contributions the study will have, and providing suggestions for future research directions in the field of hyperautomation.

2. Literature review

This study mostly used grey literature published by experts as the main source of information with the addition of academic search engines such as Google Scholar, ResearchGate, and other similar platforms.

The keywords that were used in the search were hyperautomation, RPA, maturity, readiness, automation, Business Process Management (BPM), process automation, intelligent automation, RPA implementations, process automation lifecycle, and automation maturity.

In the continuation of the Literature Review, we will go over the definitions of hyperautomation that are available, the technologies that are involved within hyperautomation, the implementation stages of hyperautomation, and the existing maturity models that are being used to assess organizations.

2.1. Definitions of Hyperautomation

In this section, we will go over the available definitions of hyperautomation remark on each definition's emphasis, and conclude with the defining characteristics of hyperautomation.

As stated earlier, the term Hyperautomation was coined by the IT firm Gartner which defined hyperautomation as a business-driven approach organizations take to strategically streamline as many processes as possible (Ray, Guttridge, Vincent, & Karamouzis, 2021). It uses multiple advanced technologies such as artificial intelligence (AI), machine learning (ML), RPA, no-code or low-code development tools, and more to build a framework that scales automation (Ray, Guttridge, Vincent, & Karamouzis, 2021). In this definition we see there are two determinants of hyperautomation, the first is the reasoning behind the approach which is to streamline as many business processes as possible and the second one is the combination of technologies that are involved within the hyperautomation approach. Although the aim is clear, the boundaries of the technologies are not given specifically.

TIBCO, one of the market leaders of BPM software providers, defined hyperautomation as the process of continuously integrating automation into the business processes of an organization with the combination of technologies like RPA, AI, and ML to augment human efforts (TIBCO). From this definition, we can state that TIBCO emphasizes on augmenting human capabilities to automate further a business process with a continuous discipline of integrating new technologies into a business. Therefore, the main highlight is the fact that hyperautomation is a continuous approach to implementing and assessing technologies in business processes.

Automation Anywhere, one of the market leaders in RPA, defined hyperautomation as an extension of legacy business process automation beyond the confines of

individual processes by integrating AI capabilities with RPA, hyperautomation enables automation for virtually any repetitive task executed by business users (Automation Anywhere). The emphasis on this definition is that hyperautomation is an added layer into the 'classical' automation where businesses can automate repetitive legacy processes without changing the current IT landscape by integrating RPA with AI capabilities.

The last definition we will go over is the definition provided by one of the market leaders of RPA, UiPath which defines hyperautomation as bringing together several components of process automation, integration tools, and other technologies that enhance the capabilities to automate work (UiPath). Starts with robotic process automation (RPA) at its core and expands automation capabilities with artificial intelligence (AI), process mining, analytics, and other advanced tools. Different from the previous definitions, UiPath stated that RPA is the first step towards hyperautomation and further enhancement with other advanced technologies and organizations could achieve hyperautomation.

Although we have presented four distinct definitions of hyperautomation provided by technology leaders, it is important to acknowledge that there are also other definitions available for businesses interested in adopting hyperautomation within their organizations. This overabundance of definitions creates ambiguity right from the beginning of the hyperautomation adoption process and exposes organizations to potential problems as they embark on their hyperautomation journey. To address this issue, we have analyzed these definitions and gathered insights from experts to provide a clearer understanding of what hyperautomation truly entails (section 4.3).

2.2. The potential benefits of Hyperautomation

Hyperautomation offers numerous benefits to organizations across various industries by leveraging advanced technologies. In this section, we will go over some of the business benefits that made hyperautomation indispensable (Atul Ashok, 2021) (Automation Anywhere) (Edlich, Alex; Phalin, Greg; Jogani, Rahil; Kaniyar, Sanjay, 2019) (UiPath) (TIBCO).

Enhancing Process Efficiency through Data-driven Insights:

Companies often fail to spot the inefficiencies and bottlenecks within their organization and processes, determining the improvement points and constantly optimizing their processes for higher returns (Walden, 2023). To do so, businesses rely on the data they generate and collect. Hyperautomation incorporates process mining, machine learning, artificial intelligence, and data analytics, allowing companies to learn more about their operations (Walden, 2023). The advanced analytics provided by hyperautomation can help businesses identify patterns and trends, detect anomalies, forecast future scenarios, and make data-driven decisions.

> "The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The

second is that automation applied to an inefficient operation will magnify the inefficiency "

-Bill Gates

In the course of a Process Automation project, certain steps are critical for success. Among these, the process discovery, process assessment, and redesign phases stand out as particularly crucial to have a solid start. During these stages, project owners, hailing from both business and IT teams, with collaboration map out the existing (AS-IS) processes and come up with a business case for the steps that are eligible for automation (Fehrer, Fischer, & Lee, 2022). They aim to improve their understanding of each step and enhance it for a more efficient and fluid process flow without bottlenecks.

To do so, leveraging advanced technologies, especially Process Mining and Task Mining, to generate valuable data becomes one of the success factors in scaling hyperautomation capabilities (Maeyens, 2022) (Detwiler, 2023). This data plays a pivotal role in shaping the optimal future state (TO-BE) of the process, one that is expected to deliver the desired business returns. This informed and strategic approach ensures that the process transformation aligns with the business objectives, and positions the organization for improved efficiency and productivity (Maeyens, 2022) (Detwiler, 2023).

Empowering Rapid Adaptation and Innovation:

In an era marked by swift changes in market dynamics, customer expectations, and regulatory mandates, the agility to adapt promptly is crucial for businesses. Hyperautomation, with its blend of robotic process automation (RPA), machine learning, AI, and integration technologies, facilitates this business agility by enabling quick and efficient automation of various processes (Haleem & Mohd, 2021). Hyperautomation empowers organizations to swiftly prototype, and implement new automation workflows in response to evolving business requirements, either by a proof of concept or an MVP product (Nimble). Hence, whether it is a market demand shift, a new regulatory stipulation, or a change in internal strategy, businesses can adapt their operations with ease.

Hyperautomation also provides continuous, real-time monitoring and analysis of automated process performance (Walden, 2023). This capability enables businesses to promptly identify and rectify any issues, supporting their operations' resilience and minimizing disruption. The scalability of hyperautomation additionally supports businesses' growth strategies (Walden, 2023) (Ciphix, 2021) (Lawton & Bernstein, 2021). As organizations expand, hyperautomation can scale to manage more processes and larger data volumes, helping businesses maintain agility amidst growing complexity.

Lastly, hyperautomation enriches the organization's capacity for innovation, a key component of business agility (Kroll, Bujak, Darius, Enders, & Esser, 2016). Automating rule-based and repetitive tasks liberates employees to concentrate on strategic and creative functions. Ultimately, hyperautomation enhances business

agility through its support for rapid adaptation to change, continuous process improvement, scalability, and boosted innovation potential.

Enhancing Employee Engagement and Satisfaction:

By eliminating the boring, repetitive, non-human added value tasks from the responsibilities of employees, hyperautomation created benefits that cannot be measured with numbers (Haleem & Mohd, 2021) (Shen, 2023). This shift allows employees to focus more on tasks that require their unique skills, and creativity, leading to a more fulfilled work experience.

When employees are empowered to tackle more complex problems and contribute on a strategic level, it increases their sense of value and investment in their roles, resulting in a boost in employee engagement (Haleem & Mohd, 2021) (Shen, 2023). This feeling of involvement not only improves job satisfaction but also leads to increased productivity and innovation, contributing to overall business performance.

Furthermore, by implementing hyperautomation technologies, businesses reduce the potential for human error associated with analog/manual tasks, and the stress that comes with it (Shethi, 2023). By using hyperautomation technologies, processes operate consistently and effectively around the business and customer expectations. The workplace becomes less burdened, leading to improved job satisfaction, and high productivity (Shethi, 2023).

Augments Return on Investment:

Hyperautomation plays a significant role in boosting the Return on Investment (ROI) for businesses (IBM Cloud Education, 2021), (UiPath), (Ciphix, 2021), (Erickson, 2023), (Shethi, 2023). Automating numerous processes leads to substantial cost savings, increased productivity, and heightened operational efficiency. With reduced manual errors and operational costs, businesses can experience a faster, more substantial ROI.

One of the primary ways hyperautomation augments ROI is through operational efficiency and process optimization. It streamlines business operations by reducing the time and resources required for executing repetitive and time-consuming tasks with the hyperautomation toolbox (Atul Ashok, 2021). This automation not only cuts down operational costs but also increases speed and accuracy, thus amplifying productivity and profitability.

Empower IT through Seamless Integrations:

Legacy systems and their often-siloed nature present significant challenges for businesses, especially when they seek to promote interoperability and communication across different functions (Irani, Abril, Weerakody, Omar, & Sivarajah, 2023). Hyperautomation offers a powerful solution for these issues.

Through the implementation of hyperautomation tools, businesses can seamlessly integrate various systems, breaking down data silos, and promoting cross-functional collaboration (SAP), (Rebelo, 2021). This benefit is essentially one of the main

reasons for RPA is being used within most organizations. Robots being able to work on human screens without making any change to a system or environment provides such ease and low cost on implementation.

Within the classical automation, provided by the IT department, the development of capabilities may require time, change in the IT infrastructure, and extensive resource allocation (Verhoef, et al., 2021). Hyperautomation fundamentally alters how businesses approach IT transformation, shifting the focus from heavy infrastructure modifications to implementing nimble and agile automation tools (Rebelo, 2021), (Atul Ashok, 2021). The businesses can see dramatic results, being able to create swift solutions without the intervention of 'classical' IT automation (Atul Ashok, 2021).

2.3. Involved Technologies

In the realm of hyperautomation, multiple advanced technologies play a crucial role in streamlining and automating business processes. The following section explores some of the key technologies commonly associated with hyperautomation.

2.3.1. Robotic Process Automation:

According to UiPath, Robotic process automation (RPA) is a technology that builds software robots with ease that mimics the human actions working on digital systems and software. Similar to people, software robots are also able to understand what's on a screen, input the right keystrokes, navigate between systems, extract data, and more. But software robots are faster and more precise than humans without given a break(UiPath).

According to Gartner, hyperautomation is the number one strategic technology trend for 2020 (Gartner, Inc., 2019). Organizations are increasingly striving to achieve end-to-end automation by integrating various technologies into a unified platform. This approach allows vendors to provide comprehensive support throughout the entire automation journey, with Robotic Process Automation (RPA) at its core. RPA serves as the foundational technology that enables organizations to streamline and automate their business processes.

Taking action, making decisions, and providing comprehensive reporting are the fundamental principles that define human capabilities in processes and tasks. Within the realm of hyperautomation, Robotic Process Automation (RPA) stands out as the technology that primarily addresses the 'taking action' principle (Lacity, Willcocks, & Craig, 2015). Therefore, RPA is the technology that is generally the first and most widely adopted technology within the hyperautomation toolbox. It enables organizations to quickly automate low-hanging fruit within their operations, leading to measurable and immediate wins (Das, 2019). This ability to demonstrate a positive return on investment (ROI) in a relatively short timeframe further justifies the adoption of RPA especially for organizations and managers seeking to demonstrate tangible profit and revenue outcomes to stakeholders and board members (Willcocks, Craig, & Lacity, 2017).

2.3.2. Artificial Intelligence:

While several definitions of artificial intelligence (AI) have surfaced over the last few decades, John McCarthy from Standford University defined AI as, " It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to biologically observable methods". (McCarthy, 2007)

Artificial Intelligence (AI) is a key technology in the hyperautomation toolbox (Mendix Technology BV). It enables machines to perform tasks that typically require human intelligence, some of the most commonly used applications of AI in hyperautomation environments are:

- Natural language processing (NLP), focuses on the interactions between computers and humans. It allows the machine to understand the human language in a contextually correct way. NLP is generally used for extracting insights from unstructured data, allowing for a better understanding and utilization of a large amount of text. This has applications in tasks such as sentiment analysis, language translation, chatbot interactions, and text summarization (Kanade, 2022).

- Image recognition focuses on making machines capable of interpreting and understanding visual data such as images and videos. By using image recognition, machines can recognize and classify objects, find patterns, and output useful information from visual data. This has use cases in various domains, including document understanding, facial recognition, and medical imaging analysis (Baheti, 2022), (Yasar, 2023).

- Cognitive reasoning (computing) focuses on simulating human thought processes, such as reasoning, problem-solving, and decision-making. Its goal is to develop AI systems in a way that machines can understand complex concepts, make logical deductions, and apply knowledge to solve problems as humans can. Cognitive reasoning models often leverage techniques such as logic programming, knowledge representation, and inference engines to emulate human-like cognitive abilities. This enables machines to evaluate and process information, make conclusions, and take appropriate actions based on the given context (Kanade, 2022).

As we mentioned taking action is addressed by mainly RPA, therefore making decisions and providing comprehensive reporting are addressed by Artificial Intelligence applications. As the primary technology for decision-making within the hyperautomation toolbox, AI is required to automatize processes where the machine needs to make logical deductions rather than following a simple business rule. As the scope of automation grows, the need for AI is inevitable (Manyika & Sneader, 2018).

2.3.3. Machine Learning:

According to IBM, machine learning is a vital subfield of artificial intelligence and computer science, it emphasizes the central importance of data and algorithms. It aims to empower machines with capabilities similar to human learning, thereby

progressively enhancing their precision and performance as humans do (IBM). It enables systems to learn and make decisions from data, drawing inferences and making predictions.

Machine learning in the space of hyperautomation, allows systems to understand, interpret and act upon complex scenarios and large volumes of data. It decreases the need for manual intervention by enabling systems to work and learn from historical data, identify patterns, and make decisions, therefore it enhances the efficiency of automated processes. Numerous business cases leverage machine learning within the automation environment such as predictive maintenance, forecasting, and fraud detection (Automation Anywhere).

Machine learning acts as a catalyst that enhances other technologies like RPA and AI. While RPA is excellent at performing standardized repetitive tasks and AI excels at making decisions parallel to the business rules, machine learning adds an extra layer of adaptability and continuous improvement, allowing systems to adapt to new situations and optimize their performance over time (Rajendran, 2021).

However, effective implementation of machine learning requires careful planning, management, and development (Zia, 2023), (DeBrusk, 2018). The quality and quantity of data used to train machine-learning models directly impact the performance of automated systems (Webb, et al., 2020). Therefore, data management strategies, including data collection, cleaning, and preprocessing, are key success factors. Moreover, ongoing monitoring and maintenance of machine learning models are necessary to ensure their stability and reliability.

Despite the challenges, integrating machine learning into hyperautomation offers great benefits. It provides a competitive advantage by enabling faster, more accurate decision-making, and improved operational efficiency. As hyperautomation continues to evolve, the role of machine learning is set to become even more significant, creating opportunities for more sophisticated and intelligent automation solutions.

2.3.4. Process Mining:

According to Celonis, the market leader for process mining describes process mining as the X-ray of businesses, it works by extracting knowledge from event logs that are available in the systems, to visualize business processes and their every variation (Celonis). It has been founded as a data-driven alternative to process mapping workshops that businesses organize to map out their operations. Professor Wil van der Aalst, the inventor of process mining, refers to process mining "as the bridge between data science (which includes algorithms, machine learning, data mining, and predictive analytics) and process science, which covers operations management and research, business process improvement and management, process automation, workflow management, and optimization (Celonis). "

In the hyperautomation landscape, process mining is a very valuable tool that supports the ‘discovery’ phase, where the opportunities within processes are evaluated for automation suitability (Maeyens, 2022), (Ciphix). Process mining provides data-driven insights that help businesses map their process flows, identify

bottlenecks and inefficiencies, and discover opportunities to streamline and automate operations. This detailed understanding of processes clears the way for the development of a robust automation strategy and improves the success rate of hyperautomation initiatives (Maeyens, 2022).

2.3.5. Application Programming Interface (API):

According to IBM (IBM), API is a prescribed set of protocols that enables communication between different applications and systems. It acts as a bridge between the systems for data transfers and enables companies to share their desired data and functionalities not only with third-party developers and business partners but also with their internal teams.

In the context of hyperautomation, APIs play an important role for the organization by seamlessly interconnecting applications that are being utilized for business operations. This connection optimizes employee productivity and also eliminates the operational silos that hinder collaboration and innovation initiatives. For developers, APIs and their documentation acts as an enabler for the interactions between the systems, thereby simplifying the process of application integration (Crerand, 2021).

Hyperautomation often involves the orchestration of different technologies, including RPA, AI, machine learning, process mining, and more (Ray, Guttridge, Vincent, & Karamouzis, 2021). APIs enable these technologies to work in tandem by standardizing the way they communicate with each other. For example, an RPA bot can use APIs to interact with an AI model, enabling it to make data-driven decisions based on the AI's output. Also for cases where UI automation is not possible, for example, to retrieve data from a web platform, APIs are critical in enabling direct, efficient, and reliable data retrieval. They facilitate the exchange of data between the RPA bot and the web platform, making it possible for the bot to access, manipulate, and use the necessary data for its tasks.

Despite the advantages, organizations must make sure the APIs are designed and implemented properly for secure data and privacy. Misuse or poorly implemented APIs can lead to data breaches and other security problems (Cobb, 2022) (Juviler, 2023). Therefore, the adoption of robust API management and security measures is essential, therefore the adoption of best practices such as implementing proper authentication and authorization protocols, encrypting sensitive data, auditing API security, and maintaining thorough documentation of API usage is highly important.

In conclusion, APIs act as critical enablers in the hyperautomation journey, allowing diverse technologies to work together in a coordinated and efficient manner. They are key to achieving end-to-end automation, significantly improving business process efficiency, and unlocking the full potential of hyperautomation.

2.3.6. Intelligent Document Understanding:

The manual approach to processing documents requires a lot of time when it comes to sorting, categorizing, and extracting relevant information. This approach not only consumes a lot of time, it is also very open to human errors. However, with the emergence of technologies like Intelligent Document Understanding (IDU), document processing can be significantly transformed (UiPath).

In the context of hyperautomation, the utilization of IDU is really important. According to research (Tay, Chuan, Chan, & Alipal, 2019) one of the biggest challenges in transformation and automation is dealing with unstructured data, which constitutes approximately 80% of a company's data according to an article published by MIT, (Harbert, 2021) and according to a survey made by Deloitte in 2019, only 18% of organizations can take advantage from these unstructured data (Davenport, Smith, Guszcza, & Stiller, 2019).

As the name is pretty self-explanatory, Intelligent Document Understanding is the capability of a system to understand and interpret documents. It is developed with the combinations of some advanced technologies such as optical character recognition (OCR), NLP, and machine learning for converting unstructured data in documents into structured data for further processing. These documents can be, invoices, shipping documents, legal documents, customer documents, records, etc.

OCR is a technology used to convert documents that are stored digitally (PDF files, scanned paper documents, or images captured by a digital camera) into editable searchable data. This means that OCR could be interpreted as the initial step in Intelligent Document Understanding, which transforms documents into machine-readable text (Tzeng, 2020).

However, OCR cannot interpret the meaning or context of the data, this is where NLP and machine learning algorithms are involved. NLP enables the systems to analyze and understand the language in the document, understand the context, and extract and classify information. On the other hand, machine learning models are used to predict and generate valuable insights from the documents based on the learned patterns (Tzeng, 2020), (Hyperscience, 2023).

Furthermore, when combined with RPA, IDU can automate the entire workflow of document processing, from capturing and understanding the document to taking action based on the extracted information. This integration can significantly improve the efficiency and accuracy of document-centric processes, enabling organizations to achieve a higher degree of automation.

2.3.7. iPaaS (Integration Platform-as-a-Service):

According to Gartner, Integration Platform-as-a-Service, or iPaaS, is a suite of cloud-based services that provides the development, execution, monitoring, and governance of integration flows that connect a variety of applications, data, and processes across different environments. In other words, it allows multiple siloed software applications to talk to each other and interact smoothly.

In the context of hyperautomation, iPaaS plays an increasingly significant role. With hyperautomation aiming to streamline and automate as many processes as possible, having disparate systems, applications, and data sources efficiently integrated has become an absolute necessity. According to MuleSoft's Connectivity Benchmark report, on average, an enterprise uses 900 applications, but only 28% of these applications are integrated, resulting in siloed data and disconnected processes (Afshar, 2020).

iPaaS creates its benefit by providing an interface for configuring and managing these integrations. It has the potential to link any set of on-premises and cloud-based operations, services, programs, and data within a single or across several organizations. This function allows for seamless data sharing and streamlined communication among an enterprise's different applications, which is a key factor for creating an integrated and automated workflow (Churchville, 2021).

However, it is important to note that even though iPaaS can significantly streamline integration endeavors, it is crucial to remember that it is not the answer to all integration problems. By comprehensive planning and understanding of business processes, data structures, and security requirements, organizations can maximize the benefits of iPaaS implementations (Churchville, 2021).

In summary, in the landscape of hyperautomation, iPaaS stands out as an essential tool. It forms the backbone of an enterprise’s ability to connect and streamline its operations, data, and applications. With a well-implemented iPaaS solution, organizations can improve their operational efficiency, agility, and ability to scale, making it a critical part of the hyperautomation journey (TIBCO).

2.3.8. Low-code/No-code Application Platform:

Outsystems, one of the market leaders on low-code development platform vendors, defines LCNC as software development approaches designed to accelerate the software development process by removing the complexity associated with traditional development. Both of these approaches use a graphical representation of components (visual programming), reusable activities, and automation to create software solutions rather than manual hand coding, but low-code and no-code are not the same things (OutSystems)

The following table shows the characteristics and differences between low-code and no-code development. (OutSystems)

Features/Characteristics	No-Code	Low-Code
Main audience	Business user or citizen developer	Professional developer
Adoption objectives	Easy to use platform to empower business users to create their departmental apps, and relieve IT backlogs	Augment developer productivity so they can focus on strategic projects and free IT up from "keeping the lights on"
Coding expertise and ramp up	None	Highly recommended, quick ramp-up
Type of project	Simple, departmental apps	Business critical solutions and sophisticated apps
Platform extensibility	Nonexistent	Developer can integrate with any enterprise system of record
Customization	Nonexistent	Developers can add custom code whenever needed
Scalability	Limited to departmental users	Enterprise-grade

Table 1: Features of a standard no-code platform versus a more advanced low-code platform.

In the context of hyperautomation, LCDC platforms play an integral role (Hoeven, 2021). As organizations are striving for end-to-end automation of their business processes, the ability to quickly create and adapt applications to changing business needs becomes a great fit with the hyperautomation approach. Via LCDC platforms, companies can quickly design prototypes, build applications, and adjust custom solutions to these applications that fit perfectly into their overall hyperautomation strategy.

Gartner claims that "by 2026, developers outside formal IT departments will account for at least 80% of the user base for low-code development tools, up from 60% in 2021" (Gartner Inc., 2022).

It is important to note, that while LCDC platforms offer significant benefits, they also have their own set of challenges (Elkoumy, et al., 2021). These include potential security risks, difficulties in managing the governance of 'citizen developers,' and the risk of creating 'shadow IT' environments. Hence, organizations must carefully manage the use of these platforms in a structured and controlled way to minimize potential issues (Krumeich, 2022), (Wijnhoven, Hoffmann, Bemthuis, & Boksebeld, 2023).

2.4. Stages of implementation

As we described in section 2.1 Hyperautomation is a comprehensive approach that incorporates an arsenal of advanced technologies. It incorporates technologies such as RPA, AI, ML, process mining, LCDC application development platforms, and many more to augment business processes. Currently, some steps are advised by technology leaders to implement hyperautomation capabilities in the organization, and in this section, we will go over the available information. As we progress through this paper, we will explore and provide insights on the implementation steps drawn from expert interviews.

According to Exasol (Golombek, 2022), which is one of the providers of high-performance in-memory database technology, hyperautomation injects automation and transformation into every aspect of the business, rather than a one-off exercise. Therefore, a foundation should be set to grow within the hyperautomation implementation. Our understanding of the eight steps is as follows:

1. **Create a strategy:** In this process, the company should evaluate its needs and ask the question 'Why do we want to implement hyperautomation?', and look for the results they want to achieve from hyperautomation. This first step is crucial since in this step, the benefits of implementing these technologies need to be identified to get people on board with this decision, allocate the needed resources, and make the required investment.

2. **Build a team:** Hyperautomation is an approach that requires commitment from both the IT personnel and business stakeholders. Therefore a need for individuals who are interconnected across the organization with the right skill set is one of the success factors. Business analysts and technology experts need to work together and combine their technical and strategic expertise to ensure the best possible result.

3. **Documentation:** From the start, the business processes and decisions that are made need to be documented to visualize the project's evolution. This will enable the company to measure the progress, learn from faced obstacles, and make improvements throughout the journey.

4. **Conduct an audit:** An evaluation of the current technology stack across the business needs to be made and processes that still need automation should be identified. There could be a lot of processes that are well covered, including data collection and Key Performance Indicators (KPIs), but other work might be completely analog and in need of a transformation to an automated process. The organization needs to identify its key priorities and create a plan around them.

5. **Set up the right technology stack:** To ensure the organization can integrate data in near-real time, it is necessary to establish a technology infrastructure that is a good fit for its purpose. The chosen solutions need to be flexible, scalable, and capable of working with different sources, like data analysts, data warehouses, and structured data.

6. **Start implementing the hyperautomation practices:**
    - Gather the data streams, establish data quality parameters, and set up a coherent data warehouse.
    - Create visual representations of the business processes across different departments.
    - Start automating decision-making within business processes across the departments that have been identified as priorities.
    - Consider the possibility of utilizing AI/ML models for training and continuously improving the decision-making process.
7. **Education:** Upon establishing the hyperautomation infrastructure, it is important to ensure that the people are trained and well-equipped with the necessary data literacy, and analysis and have the right tools and skills. This will enable them to gain the maximum benefit from the new automated functions.
8. **Continuous improvement:** Strive for improvement by obtaining a comprehensive, end-to-end, view of the organization's business operations. This will foster transparency, inspire information sharing, and instigate the right discussions within and across departments. Such a level of communication and collaboration will result in better decisions and will enhance your overall business performance.

According to Exasol's current CTO, Mathias Golombek, understanding these steps are crucial before starting the hyperautomation journey, and will increase the chances of success. We have included these steps because they not only provide a structured roadmap to hyperautomation implementation but also because they underscore the importance of comprehensive planning and continuous improvement. In addition to technological advancements, the process requires a deep-rooted understanding of organizational dynamics, cross-functional collaboration, and the will to continually adapt and learn.

2.5. Existing Maturity Models

In this section, we will go over the available maturity models that can be used for effective hyperautomation. In our quest to provide a comprehensive understanding, we will extract insights from several well-established maturity models which are the Automation Maturity Model by Microsoft and the Integration Maturity Model by Gartner.

While these models provide a structural framework and define different levels of maturity, they lack prescriptive measures, an aspect crucial to the practical application of the model. Research (Becker, Knackstedt, & Peoppelbuss, 2009) underlines that a maturity model serves a prescriptive purpose if it highlights desirable maturity levels and offers guidelines for improvement measures. As Maier

(Maier, Moultrie, & Clarkson, 2009) posit, "Specific and detailed courses of action are suggested."

As we progress through this paper, we aim to not only explore these models but also enrich them with prescriptive insights derived from expert interviews. Our goal is to provide a robust and comprehensive understanding, enabling organizations to pinpoint their current status and effectively chart their course toward advanced levels of hyperautomation maturity.

2.5.1. Automation Maturity Model by Microsoft Power Automate

The Automation Maturity Model by Microsoft (Krishnamurthi, 2022) is a comprehensive five-level framework that is designed to guide organizations and their partners to think about how their capabilities can be improved further to their desired business outcomes. It has been inspired by Holistic Enterprise Automation Techniques (HEAT) (Rastogi, 2021) and the Capability Maturity Model (CMMI) (ISACA).

HEAT – Holistic Enterprise Automation Techniques

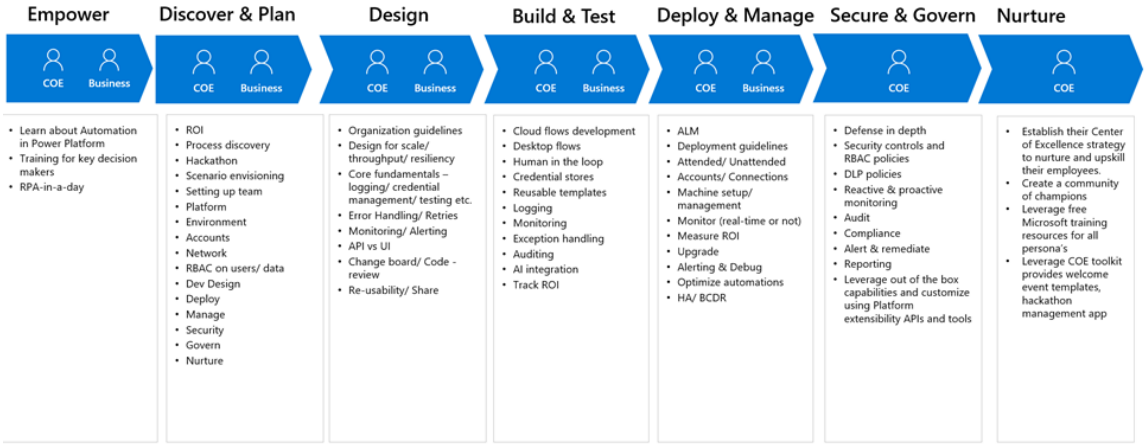

Figure 3: HEAT Model

The HEAT model is built upon experiences and learnings from the Microsoft automation solution, Power Automate (Rastogi, 2021). It describes the life cycle of an automation project and outlines best practices at each stage by using their automation tool Power Automate. Although it is focused on Power Automate, the stages apply to all automation projects, since the RPA lifecycle is generally the same for each product. Therefore, it serves as a reference point for developers and Centers of Excellence (COEs) aiming to implement and govern automation adoption at a large scale, but since the focus is on Power Automate the actions needed within these stages can change.

According to (Rastogi, 2021) automation life cycle consists of the following 7 stages:

1. **Empower**: The start of any successful automation project is to ensure that the key stakeholders understand the automation capabilities of the platform. In this stage, users get compliant with the capabilities of the automation platform they use.

2. **Discover & Plan:** This is the stage where the decision on which business cases are going to be automated is based on the ROI. Setting up the development team and necessary automation environments is also done at this stage.

3. **Design:** In this stage, the team needs to define the design principles to lay the foundations for scalability, security, and compliance for the automation solutions.

4. **Build & Test:** This is the stage where development takes place by the developer, and tests are being made to make sure the project is ready to be deployed.

5. **Deploy & Manage:** In this stage, the automation team uses the capabilities of their platform to efficiently manage the deployment cycle automation tasks such as scheduling, queuing, and prioritizing automation tasks. Developers can establish CI/CD pipelines with integrated testing to prevent accidental modifications that can disrupt the live production environment.

6. **Secure & Govern:** In this stage, automation teams utilize in-built security controls to establish protective measures, allowing the organization to scale RPA securely.

7. **Nurture:** Automation teams establish a strategy to nurture and upskill employees, create a community of champions, conduct training sessions, run hackathons, and promote success stories.

CMMI - Capability Maturity Model

The Capability Maturity Model Integration (CMMI) offers a structured approach for organizations to assess and improve their processes and operations. Comprising two distinct yet interconnected parts, namely capability levels and maturity levels, CMMI provides a path toward continuous improvement and performance optimization. (ISACA)

Capability levels focus on an organization's performance and process improvement within individual practice areas (Watts, 2020), (Microsoft, 2023). Ranging from Level 0 (Incomplete) to Level 3 (Defined), these denote an organization's progression towards improving specific processes. At Level 0, the approach to meeting the practice area's intent is incomplete and inconsistent. As organizations move towards Level 1 (Initial), they begin addressing performance issues, though their approach remains incomplete. At Level 2 (Managed), organizations possess a simple yet complete set of practices addressing the full intent of the practice area, even without the use of organizational assets. Finally, at Level 3, organizations employ organizational standards and resources, focusing on achieving both project-specific and organization-wide performance objectives.

In contrast, maturity levels represent an organization's overall progression on a staged path toward performance and process improvement across predefined sets of practice areas (ISACA). These levels indicate the organization's broader

operational maturity and provide a holistic view of its approach to business processes. At Level 0 (Incomplete), work completion is ad hoc and uncertain. Level 1 (Initial) is characterized by unpredictability, with work often delayed and exceeding budget. Level 2 (Managed) sees projects becoming planned, performed, measured, and controlled at the project level. Progressing to Level 3 (Defined), organizations shift from a reactive to a proactive stance, with organization-wide standards guiding various initiatives. At Level 4 (Quantitatively Managed), organizations become data-driven, with predictability and alignment with stakeholder needs becoming key. Finally, Level 5 (Optimizing) organizations demonstrate stability and flexibility, continuously improving while also displaying agility and innovation.

Through the CMMI model, organizations can gauge where they currently stand in their process maturity and identify specific areas where improvements are necessary. This allows them to take targeted action, enabling a steady progression toward better performance and higher process maturity (ISACA), (Watts, 2020), (Microsoft, 2023), (White, 2021), (Alfaro, 2022).

By combining these 2 models, HEAT & CMMI, Microsoft generated the Automation Maturity Model (Krishnamurthi, 2022):

Automation Maturity Model

	L100 INITIAL	L200 REPEATABLE	L300 DEFINED	L400 CAPABLE	L500 EFFICIENT
Empower	*Training resources available and Automation CoE have a fair grasp on tool capabilities and usage.*	*Organizations have a standard training curriculum that gives new users a starting point. All makers have undergone basic Power Automate training.*	*Extend lessons learnt and share knowledge across the various verticals internal to the organization.*	*Contribute to the community of Power Automate practitioners external to the organization.*	*"Help us - Help you" - give Microsoft active feedback. Share thoughts on how we can serve you better*
Discover & Plan	*Initiate technology readiness discussions with supporting IT/Business teams.*	*Organizations document accepted priorities and concerns, initial draft to address foundational aspects of Power Automate are addressed. Strategy plan is defined with a bias towards a "CoE led - Business supported" model*	*Strategic planning document is enriched such that organizational level security and governance level parameters are addressed.*	*Strategic planning document includes ideation around advanced reporting constructs, AI based automation strategy, process mining tools with a bias towards a "Business led - CoE supported" model.*	*Strategic planning document is complete with necessitate revisions from time to time. Business and technology teams are aligned on strategy and corresponding investments.*
Design	*Initial design is scoped to support experimentation with Power Automate as the organization familiarizes with the tool.*	*Organizations document accepted priorities and concerns, initial draft to address foundational aspects of Power Automate are addressed. Strategy plan is defined with a bias towards a "CoE led - Business supported" model*	*Design is scoped towards supporting many bots for production usage needs for the enterprise. Organization is maturing in it's automation journey.*	*Design is scoped towards supporting many bots across cross-functional teams for production usage - leveraging AI/ML, custom connectors and advanced error handling.*	*Design is scoped towards supporting many bots across cross-functional teams for production usage - leveraging AI/ML, custom connectors and advanced error handling.*
Build & Test	*Initial pockets of success is realized from an implementation standpoint. CoE validates feasibility of the solution by building proof of concepts to support simple use case scenarios*	*Initial pockets of success is realized from an implementation standpoint. CoE validates feasibility of the solution by building proof of concepts to support simple use case scenarios*	*Implementation is targeted towards building many bots for production usage. Organization is maturing in it's automation journey.*	*Implementation is targeted towards building many bots for production usage. Organization is maturing in it's automation journey.*	*Implementation maturity is at an advanced state. Organization is well equipped to build complex processes with a high degree of resilience.*
Deploy & Manage	*Scope of deployment/management is to support automation at a PoC level.*	*Scope of deployment/management is to support a few bots for production usage.*	*Scope of deployment/management towards supporting many bots for production usage. Organization is maturing in it's automation journey*	*Scope of deployment is targeted towards supporting bots serving cross-functional teams for production usage with a bias towards optimization and efficiency*	*Scope of deployment/management is at a mature state. Organization is well equipped to deploy and manage solutions efficiently ensuring a high degree of resilience.*
Secure & Govern	*Security and Governance is envisioned to support automation at a foundational level to facilitate future growth.*	*Security and Governance is envisioned towards supporting a few bots for production usage.*	*Security and Governance is envisioned towards supporting many bots for production usage. Organization is maturing in it's automation journey.*	*Security and Governance is targeted towards supporting bots serving cross-functional teams for production usage with a bias towards optimization and efficiency.*	*Security and Governance is at a mature state. Organization is well equipped to secure and govern solutions efficiently ensuring a high degree of resilience.*
Nurture	*Organization has just begun it's automation journey, the objective is to evangelize Power Automate adoption at a foundational level.*	*Organization is expanding it's automation footprint, whilst still evaluating feasibility from a scale perspective. Nurture is geared to support and promote makers who have a fair grasp of Power Automate.*	*Organization ascertains Power Automate as a viable solution. The organization is maturing in it's automation journey and with it comes many "learning moments". "Nurture" at this level is attuned to support growing pains typical to increasing maturity.*	*Organization is increasingly tending to a mature state in it's automation journey. Business and Technology works synchronously and are aware of their inter-dependent roles.*	*Organization is at a mature state in it's automation journey. Organization help uplift other enthusiasts looking to progress in their automation journey.*

Figure 4: Automation Maturity Model by Microsoft Power

Essentially, this model provides an approach to managing each stage of the automation life-cycle, as delineated in the HEAT model, corresponding with each maturity level outlined in the CMMI model. Although this model has defined and described stages it fails to provide guidance and a set of actions to scale through these levels. Therefore, it is safe to state that it has some improvable areas in terms of a maturity model since it has been stated in the research (Poeppelbuss &

Roeglinger, 2011), (Maier, 2009) that a maturity model needs to be specific and suggests detailed courses of action.

2.5.2. Integration Maturity Model

The Integration Maturity Model proposed by Gartner (Gartner Inc., 2023) provides a structured approach for software engineering leaders to enhance their application integration strategies. This is particularly relevant for hyperautomation because, as we mentioned in 2.1 TIBCO highlighted hyperautomation as the process of continuously integrating automation into the business processes of an organization, therefore achieving a high level of maturity integration is crucial for successful hyperautomation (TIBCO).

Gartner's model considers five dimensions: Strategy, Ownership, Technology, Delivery, and Operations. Each dimension assesses different aspects of the organization's approach to integration. By evaluating these, organizations can identify key areas that need improvement and increase their overall integration maturity. The overall maturity stage is determined by combining levels across all five dimensions, and progression requires that most dimensions are at or above that level, with none more than one level below the overall stage.

Summary of Five Dimensions:

Dimension	Summary
Strategy	What is the awareness of integration as a distinct competency in the organization?
Ownership	Who defines standards and policies for how integration should be used?
Technology	What tools and frameworks are used for integration use cases?
Delivery	Who is responsible for building new integrations?
Operations	Who manages integration instances and how is insight into their operation used?

Source: Gartner (April 2023)

Figure 5: Summary of five dimensions by Gartner

The maturity levels and their characteristics change for each dimension, which we will go over shortly to have a broader understanding.

Strategy:

Level 1: No strategic thought is given to integration.

Level 2: Integration is a known problem recognized by IT leaders however, the approach is project-by-project.

Level 3: Integration is a recognized competency within the organization. Strategy and approaches are defined managed and governed by a central entity, COE or ICC.

Level 4: The Center of Excellence (COE)/Integration Competency Center (ICC) has become a critical business enabler and evolved into an empowerment team, the Integration Services Enablement Team (ISET). They define and govern the integration strategy. Critical integrations are still made by the ISET but they also actively facilitate decentralized delivery for teams that want to fulfill their integrations.

Level 5: The integration strategy is perpetually evolving, concentrating on business enablement and ongoing enhancement. The Integration Services Enablement Team (ISET) consistently strives to refine best practices, processes, and skills through collaboration with all internal and external integration stakeholders, including business partners.

Ownership:

Level 1: There is no structured approach to integration and responsibilities are not defined.

Level 2: There may be an enterprise architecture team that defines some guidance on the integration approach however, ownership reams project-based without any formal governance.

Level 3: Integration is managed by an ICC/COE. This team centrally supports and fulfills requirements.

Level 4: The ISET offers frameworks and tools as part of a centrally governed and managed service. This service integrates various scenarios and supports both centralized and decentralized delivery through clearly established governance processes.

Level 5: Integration is embedded in the organization's culture. Collaborative capabilities are established, and the ISET ensures that integration is viewed as a widespread, cross-organizational skill involving both internal and external business partners.

Technology:

Level 1: Integration requirements are addressed without any formally defined approach.

Level 2: Some technologies are evaluated and selected, however, the use of these technologies is not widespread and there is limited awareness.

Level 3: There are dedicated financial and human resources to define and centrally support integration under the control of ICC.

Level 4: The ISET defines a hybrid integration capability framework that is used to select tools to address both systematic requirements and adaptive requirements that enable a wider community of users.

Level 5: The ISET has full-functional multiperson integration capabilities. ISET provides training and mentorships and supports the use of the integration capabilities on an ongoing basis.

Delivery:

Level 1: Integration is implemented ad hoc basis.

Level 2: Delivery is the responsibility of the project. There is no formal process for delivering integration outside of the project team.

Level 3: Delivery is centralized under the ICC. The ICC defines and promotes best practices. Standardized processes, reusable artifacts, and guidelines.

Level 4: Complex projects are still delivered by the ISET, but they are also supporting delivery by business and project teams.

Level 5: The Organization's integration capabilities are extended to support delivery by all authorized users who are using enterprise standards and approaches.

Operations:

Level 1: There is no process for monitoring or managing integrations separately from applications.

Level 2: Operational and management features are built for some sort of tracking but there is no overall operational approach.

Level 3: Integration is deployed and managed centrally. Monitoring of integration is done by ICC.

Level 4: IT Platform teams oversee the shared infrastructure, while business or project teams handle resolving errors and issues in their integrations. There is a strong alignment between organizational and corporate goals, with continuous, large-scale monitoring of relevant metrics, Key Performance Indicators (KPIs), and Service Level Agreements (SLAs).

Level 5: Proactive Artificial Intelligence for IT Operations (AIOps) is established within the organization. Automation and observability tools are implemented across all systems and integration interfaces, facilitating thorough alerting and analysis.

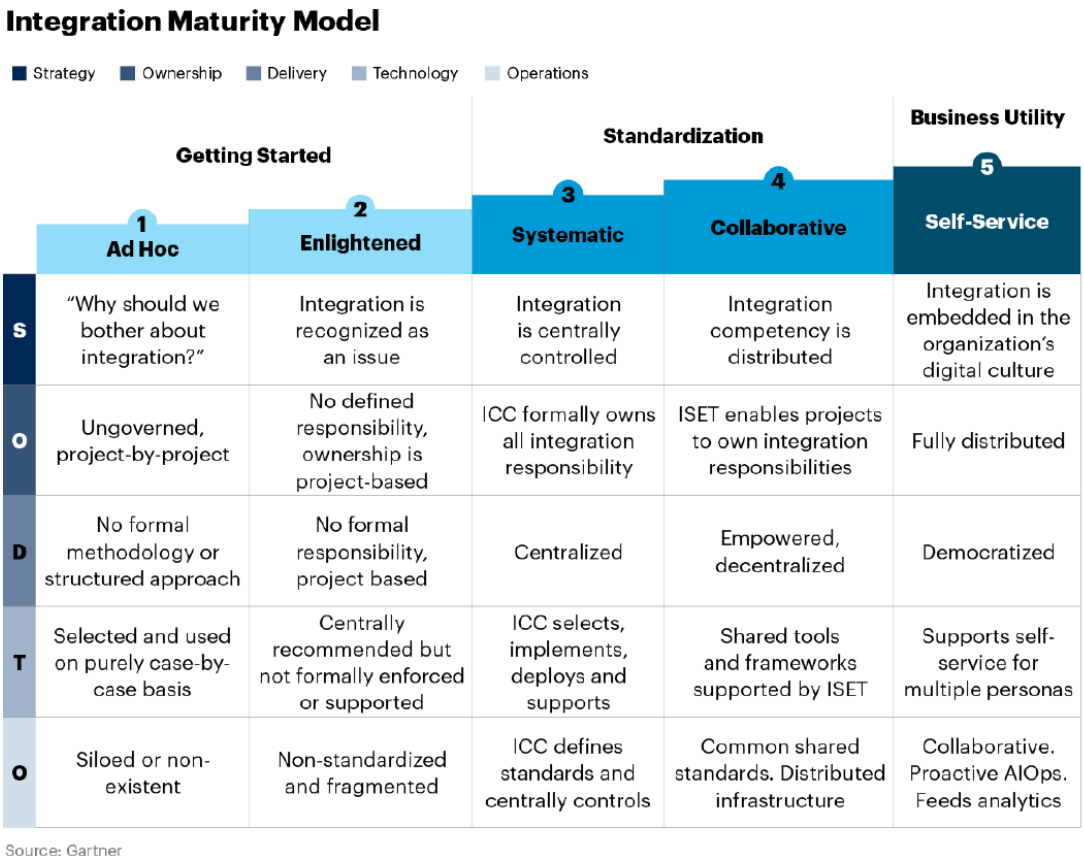

Figure 6: Integration Maturity Model by Gartner

This model effectively evaluates different aspects of an organization's integration approach across five dimensions: Strategy, Ownership, Technology, Delivery, and Operations. However, as a hyperautomation maturity model, it might require certain extensions or modifications since it is focused on integration technologies.

Firstly, the model heavily relies on IT structures, teams, and resources. While this is appropriate for many integration tasks, hyperautomation extends beyond IT (SAP). It encompasses the entire organization and thus requires engagement from all business units, not just IT (Emergen Research, 2023). Therefore, the model could benefit from a more explicit focus on organization-wide engagement and the need for business-wide understanding and involvement in automation initiatives.

Secondly, while the model thoroughly covers integration, it lacks explicit emphasis on the broader spectrum of automation technologies that contribute to hyperautomation. It does not provide a clear roadmap for the evolution and incorporation of diverse automation tools such as RPA, ML, and AI. Given the diversity of tools involved in hyperautomation, a comprehensive hyperautomation maturity model should guide organizations in integrating and managing a wide array of automation technologies (Erickson, 2023).

Thirdly, hyperautomation is not just about technology and processes, but also about people and culture (SAP). It involves transforming the organization's culture to embrace continuous improvement, resilience, and agility (Patwardhan & Sreekant). The model could be expanded to capture the cultural and change management

aspects more explicitly, including elements like training, education, and fostering a culture of innovation.

3. Methodology

In this section, we will describe the research approach and methodology that we followed to answer our research questions.

3.1. Research Method

We have followed the design science research process given by (Peffers, et al., 2006) as the roadmap to follow in our research.

Hevner et al. stated (Hevner, March, Park, & Ram, 2004), design science research (DSR) is a paradigm that focuses on developing and evaluating innovative artifacts to solve complex problems in a specific domain. Its primary aim is to create knowledge by producing and evaluating these artifacts that can address real-world problems. It is a good fit for our research since the nature of this research objective required a practical, innovative solution to a complex real-world problem: how to guide organizations on their hyperautomation journey.

The DSR paradigm (Peffers, et al., 2006), as given in the figure below is built around a core set of principles: understanding the problem domain, defining the objectives for a solution, designing and developing the solution, demonstrating the operation of the solution, evaluating the solution, and communicating the results. We followed this methodological framework, which provides both process guidelines and evaluative criteria for our research.

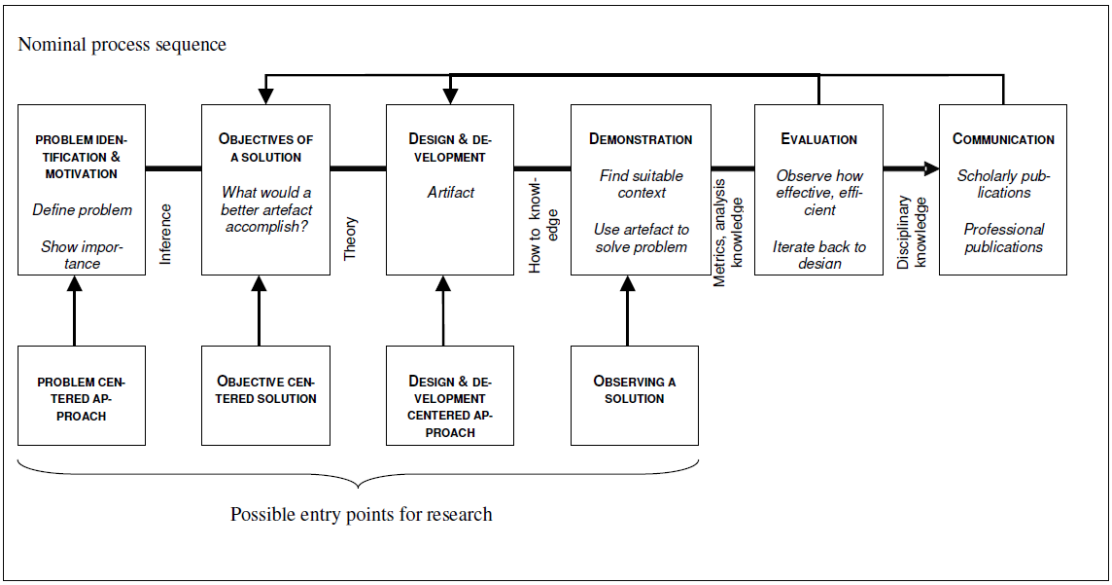

Figure 7: Design science research process (DSRP) model

Problem Identification & Motivation: In this first stage, we conducted an extensive literature review to understand the problem domain and the context of our research. We studied various sources such as academic articles, industry reports, and grey literature (Garousi, Felderer, Mäntylä, & Rainer, 2020). After the review, we held exploratory interviews with experts from the field to have a better

understanding of the hyperautomation domain. Doing so we found that companies are struggling to find the right approach to implement and grow their automation capabilities further in their organization, as mentioned in section 1.2 Research problem.

Objectives of a Solution: After thoroughly understanding the problem domain, we defined our research objectives and our research questions in sections 1.3 and 1.4. These research questions were designed to address the gaps identified in the literature review and exploratory interviews. Specifically, they sought to enhance understanding of hyperautomation, guiding organizations on how to successfully implement hyperautomation strategies, thereby mitigating the risk of failure in their automation initiatives. We recognized that a Hyperautomation Maturity Model could be utilized as a roadmap by organizations for shaping their automation journey and would be the solution to the research problem we have.

Design & Development: After the identification of our objectives is clear, we have moved on to the design and development phase of our research which is detailed in section 5. We focused on the creation of a Hyperautomation Maturity Model as an artifact to guide organizations in their hyperautomation journey. Drawing from the literature review of currently available maturity models and the insights we get from the interviews we have done with the experts, we developed an initial model. This model contains several levels of maturity, each with a set of capabilities that an organization should possess to achieve that level. We have designed the model to apply to any company, allowing organizations to modify it based on their specific contexts and needs.

Demonstration: To showcase the practical application and value of the Hyperautomation Maturity Model, we initiated a demonstration phase with experts in the field. As discussed in section 4 we organized a series of meetings where we presented the developed model, its components, and its intended use. In these sessions, we illustrated how organizations could use the model to map their current automation maturity, identify gaps, and establish a structured roadmap to progress their hyperautomation capabilities.

Evaluation: After the presentation of the model, we had a feedback session where we distributed a questionnaire to the experts to assess the model on its usefulness, ease of use, subjective norm, voluntariness, compatibility, and intention to use. This questionnaire was designed using the principles of the Technology Acceptance Model (TAM) (Riemenschneider & Hardgrave, 2002). The reason behind this was to prove the utility of the model. We have selected to assess the model under these six segments because in the research done by Riemenschneider and Hardgrave (Riemenschneider & Hardgrave, 2002) these segments were selected to assess 5 different Capability Maturity Models (CMM) since our model is in that category we think these six segments will be comprehensive enough to evaluate our model. This interactive process provided valuable insights and allowed us to illustrate the practical value of our research artifact which is discussed in section 4.

Communication: The final phase of our research process involved the thorough documentation and effective communication of our research findings and the Hyperautomation Maturity Model.

To summarize, using a design science approach allows us to gain knowledge and understand the problem domain and the solutions needed for solving them. Using this approach will result in building and applying artifacts (Hevner et al., 2004).

3.2. Exploratory Interview

The rationale behind conducting exploratory interviews was to gather insights that would answer our research questions and guide the creation of our Hyperautomation Maturity Model. Our research questions encompassed a broad spectrum before narrowing down to a specific focus within the realm of hyperautomation with our main research question:

> Q3 – What are the dimensions that organizations need to mature to scale their hyperautomation capabilities?

We have also adopted this approach with our literature review and exploratory interviews as we began with a wide-angle exploration of hyperautomation and gradually delved deeper into specific aspects of it, ultimately addressing the key information needed to guide organizations on scaling their hyperautomation capabilities.

3.2.1 Interview Strategy

The decision to incorporate exploratory interviews with industry experts was driven by the understanding that hyperautomation is a rapidly evolving field, where real-world practices, technologies, and challenges may outpace academic documentation. Gathering insights from those at the forefront of hyperautomation implementation would ensure our research stayed relevant, practical, and reflective of the current state of the industry.

Exploratory interviews stand in contrast to confirmatory interviews, which we will use as an instrument in the later phase of evaluation, described in section 5.

3.2.2 Interview Approach

According to research (Karl, Peluchette, & Aghakhani, 2022), due to the pandemic, many people adopted work from home style of working, which has increased the capability and the use of video conferencing technologies. With this evolution in communication norms, we've tailored our interview methodology to accommodate these changes. We have decided to conduct interviews primarily face-to-face to capitalize on the benefits of in-person interaction, such as more nuanced understanding through non-verbal cues. However, acknowledging the current realities and the potential logistical challenges, we have decided to conduct interviews virtually via Microsoft Teams, when in-person sessions are unattainable.

3.2.3 Interviewee Selection

The selection of interviewees played a crucial role in the quality and reliability of our data. The goal was to include individuals with deep knowledge and first-hand experience in the field of hyperautomation, who could provide practical insights to complement the theoretical underpinnings of our research.

We collaborated with Roborana Netherlands, a hyperautomation consulting firm specializing in integrating automation solutions for mid to large-scale enterprises across various industries. They facilitated our access to key industry experts. Consequently, we were able to conduct in-depth interviews with five hyperautomation consultants from their team and five people outside of Roborana. These professionals offered a wealth of knowledge due to their extensive involvement in the industry and their hands-on experience in guiding organizations through their hyperautomation journey.

Our selection was driven by two main criteria: professional expertise and diverse experiences. The range of roles among our interviewees was quite broad, including consultants, developers, managing partners, team leads, and researchers. These experts not only had a profound understanding of hyperautomation, but they also brought to the table a variety of perspectives from their diverse experiences, further enriching the findings of our study.

3.2.4 Interview Structure

We have considered two types of interview structures for our interviews, structured and non-structured interviews.

Structured interviews follow a pre-set list of questions, with little to no deviation (Wethington & McDarby, 2015). This method ensures consistency across interviews and allows for easier comparison of data. However, its rigid format can limit the depth of responses and potentially overlook valuable insights that fall outside the pre-defined scope.

Non-structured interviews, on the other hand, are more open-ended, providing room for interviewees to share broader and in-depth insights (Wethington & McDarby, 2015). This approach fosters a more conversational style of interview, enabling the exploration of unexpected topics or ideas that arise. Yet, it can be challenging to directly compare the data gathered due to its more variable nature.

Due to the limitations of each of the approaches, researchers and we preferred to use semi-structured interviews to benefit from the advantages of each approach while mitigating their respective disadvantages (Wethington & McDarby, 2015) (Young et al., 2018). It also gave us the flexibility to dive deeper into the insights given by the interviewees while having the interview.

3.2.5 Interview Questions

The development of our interview questions was all designed to contribute toward answering our research questions and in the meantime provide a comprehensive understanding of the field.

For instance, with research question Q1 – "What is hyperautomation?", our interview questions 1, 2, 3, and 4 given in the appendix section Interview Questions, aimed to understand experts' background, thoughts on the definition of hyperautomation, common technologies included in the toolbox, and the rationale behind implementing hyperautomation capabilities. The answers to these questions offered practical insights into how hyperautomation is understood and used in real-world scenarios, which expanded and enriched our academic understanding from the literature review.

Regarding research question Q2 – "What are the stages of a hyperautomation implementation?", interview questions 5, 6, 7, 8, 9, 11, and 13 sought to draw out the experts' past experiences with implementing hyperautomation in various organizations. Their answers provided us with an understanding of the hyperautomation journey, allowing us to identify best practices, challenges, and success factors in these implementations.

Finally, for research question Q3 – "What are the dimensions that organizations need to mature to scale their hyperautomation capabilities?", we constructed interview questions 10, 11, 12, 13, 14, and 15. Responses to these questions provided insights into the aspects of an organization that influences its ability to scale hyperautomation, including organizational attributes, governance procedures, and defining the quality of provided solutions.

4. Interview Methodology and Results

After conducting the interviews, we needed to analyze the data to gain insights needed for the development of our maturity model. For the analysis, we needed to prepare our data and for that, we transcribed our interviews.

Upon completion of the transcriptions, we initiated a thematic analysis of our interview data. Thematic analysis is a widely used research method that involves analyzing, identifying, and interpreting patterns of meaning (themes) within the data (Herzog, Handke, & Hitters, 2020). This approach enabled us to decode and categorize the information into meaningful segments.

We began by familiarizing ourselves with the data, reading and re-reading the transcriptions to fully grasp the content and context. Following this, we started to generate initial codes, marking significant or recurrent ideas in the data. These codes served as labels for allocating units of meaning to the descriptive or inferential information compiled during the study.

Subsequently, we began to identify themes, linking codes together that formed a common or recurrent idea. These themes provided a broader perspective on the data, capturing insights that are important to our research questions.

4.1. Interviewee information

This section provides an overview of the interviewees, their roles, and experience within the field. Due to confidentiality, we identify the interviewees by letters and do not provide information about their organization.

Interviewee	Interviewee Role	Experience in the IT industry (in years)
A	Intelligent Automation Consultant	5
B	Product Owner Hyper Automation Team	25
C	Intelligent automation consultant	1
D	Intelligent automation consultant	14
E	Founder & Managing Partner	10
F	Intelligent Automation Consultant	5
G	Co-Founder & Managing Partner	20
H	Digital Evolution Strategist & Managing Partner	8
I	RPA, Integration & API Management Product Owner	25
J	Head of Research	45

Table 2: Interviewee information

4.2. Interviewee role descriptions

This section provides more information on the interviewees and their responsibilities.

Interviewee	Details

A	Interviewee A is an Intelligent Automation consultant at a hyperautomation consultancy firm. Focuses on connecting business needs with innovative automation technologies. He handles various tasks, including architectural design, development, implementation, and maintenance of hyperautomation solutions. He specializes in RPA technology.
B	Interviewee B is currently serving as the Product Owner of the hyperautomation team within his organization. He plays an important role in driving and shaping hyperautomation initiatives. His role involves monitoring the development of automation solutions, as well as managing and coordinating the team. With a 25-year-long career in technology, his experience has centered on the forefront of emerging technologies.
C	Interviewee C has worked as a freelancer in the Business Intelligence (BI) world. Later He joined a company focused on Robotic Process Automation (RPA) a year ago and currently serves as an Intelligent Automation Consultant. He handles various tasks, including architectural design, development, implementation, and maintenance of RPA solutions.
D	Interviewee D is an Intelligent Automation Consultant at a company primarily engaged in RPA, although they cover the whole spectrum of hyperautomation. He is involved in various aspects including architectural design, robot construction, design, and maintenance.
E	Interviewee E serves as the founder of a company specializing in hyperautomation, which started as an RPA Consultancy firm. Then the company expanded under his guidance to include seven entities, each dedicated to different aspects of the hyperautomation, providing quality service to their clients.
F	Interviewee F has been working at Roborana, holding a hybrid position blending RPA consulting with business development. As an Intelligent Automation consultant, he is engaged in development and architecture, providing a full-stack perspective and working on a broad range of tasks from technical to strategic.
G	Interviewee G currently co-leads a company specializing in the advanced fields of hyperautomation and autonomous enterprises, striving to enhance business process efficiency and innovation. Drawing on his extensive experience since 2008, he brings expertise in a range of technologies including RPA and process orchestration.
H	Interviewee H is a partner at a technology consulting firm helping organizations with the process discovery phase and has over eight years of experience in the industry. His career started in a multinational professional services firm's technological solution practice, later advancing into the SAP and ERP sectors.
I	Interviewee I is the Product Owner for RPA, Integration & API management at an energy company, with over two decades of experience in automation and process flow. He is focusing on driving efficiency and cost reduction through process optimization and automation. Since 2016, his role has shifted towards RPA. His

	career spans diverse domains promoting process enhancement through innovative tools and software.
J	Interviewee J is an experienced technology expert, primarily focusing on automation and integration technologies. They started their career in the vendor community, working on automation, and then spent 25 years at a leading research and advisory company. Here, they specialized in studying and advising on technologies like integration platforms, API management, and BPM technologies.

Table 3: Interviewee Details

4.3. Hyperautomation definitions according to interviewees

This section provides information on the interviewees' definition of hyperautomation. We have provided the direct quotes and emphasis they are making on the hyperautomation. Refer to the Appendix: Hyperautomation definitions according to interviewees.

The definitions of hyperautomation provided showcase varied interpretations, but there are common threads throughout. These shared themes include:

Integration of Multiple Technologies: All the definitions given by the interviewees indicated the collaboration of multiple technologies as an essential attribute of hyperautomation. They pointed out that it includes a broad range of tools, such as RPA, Artificial Intelligence (AI), Machine Learning, Process Mining, and Low-Code platforms, etc. but hyperautomation is not limited to these technologies. This emphasis on technology integration highlights the urgency to move beyond single-tool solutions to a more complex, synergistic, and interconnected landscape of technological applications.

End-to-End Process Automation: Five of the interviewees (C, E, F, H, J) highlighted the importance of complete, end-to-end automation in hyperautomation. They suggested that hyperautomation goes beyond automating isolated tasks and instead focuses on automating entire workflows or business processes within an organization. It requires a thorough understanding of the process flow and a broad strategy to fully automate processes.

Enhancement of Efficiency and Cost Reduction: Seven interviewees (A, B, D, F, G, I, J) mentioned that the ultimate goal of hyperautomation is the improvement of operational efficiency and the reduction of costs. They inferred that hyperautomation could help companies become more competitive by increasing their operational speed and efficiency, at the same time reducing costs associated with manual work.

Business-Centric Approach and Value Addition: Six interviewees (C, E, F, H, G, J) highlighted that hyperautomation strategies should be driven by business needs and aim to create business value across an organization. It concludes that hyperautomation is not simply a technological shift and can't be achieved by just adopting new technologies, but a strategic business transformation that is expected to deliver tangible benefits in terms of value addition.

Strategic Mindset: Seven interviewees (A, C, E, F, G, H, J) noted that hyperautomation is a mindset or strategic approach more than just a simple application of technologies. This perspective suggests that hyperautomation is a systemic shift in how organizations perceive and implement automation. The choice of technologies should be dictated by the problem at hand, leading to a 'toolbox' of various technological solutions that can be applied as required.

4.4. Hyperautomation technology toolbox according to interviewees

This section provides the technologies that are included in hyperautomation according to the interviewees.

Interviewee	A	B	C	D	E	F	G	H	I	J
AI	x	x		x	x	x	x			x
API	x		x	x		x	x		x	x
BI			x							
BPM									x	x
IDU	x			x		x	x			
iPaaS				x	x		x			x
LCNC	x				x	x	x	x		x
ML	x	x			x	x	x	x	x	x
NLP	x			x			x			
Process Mining	x	x	x	x	x	x	x	x	x	x
RPA	x	x	x	x	x	x	x	x	x	x

Table 4: Interviewee Result on included technologies

According to our interviewees, these are the common technologies we see in hyperautomation implementations, they all have some unique capabilities that make them a good fit for hyperautomation business cases.

The boundary that distinguishes a technology as a hyperautomation tool is often not specifically defined as the interviews revealed. The technology stack for hyperautomation is dynamic and in the future, we may see different technologies that could be beneficial to hyperautomation, and new technologies could be added to this stack.

One of the comments made by Interviewee B about which technologies are considered hyperautomation technology had our attention, he said “I don't want to go into the wording definitions but combining intelligence with the ability to do actions with the ability of monitoring, looking at it, visualizing it. Those three combined is what I would include in the hyperautomation toolbox.”

Interviewee B's comment defines the three primary elements that form the core of hyperautomation: intelligence, action, and monitoring with visualization. This suggests that any technology that satisfies these three elements can be considered a part of the hyperautomation toolbox.

As mentioned, the line between what can be considered hyperautomation technology is blurry and constantly evolving. We can expect that as technology continues to advance, new tools and technologies will emerge that will enhance and expand the capabilities of hyperautomation, offering even greater efficiency and intelligence in automating business processes.

4.5. Hyperautomation maturity stages according to interviewees

This section provides interviewees with descriptions of the stages of the hyperautomation journey.

Each of the interviewees has different, but complementary views on the stages of the hyperautomation approach. From their answers, we see that hyperautomation is a journey that generally starts from a low maturity level where organizations may not even be aware of the concept or its benefits (Interviewee A, Level 0 No Awareness; Interviewee B, Level 1; Interviewee F, Level 0; Interviewee G, Level 1; Interviewee H, Stage 1) and grows to a higher maturity level where automation initiatives are democratized, interconnected, and autonomous (Interviewee A, Level 5; Interviewee B, Level 6; Interviewee C, Intelligent Automation Innovator; Interviewee D, Principle 6; Interviewee E; Interviewee F, Scaling Up; Interviewee G, Advanced Maturity Stage; Interviewee H, Culture of Innovation Stage).

However, it's important to highlight that this transition doesn't have to be a linear process but is rather a multidimensional evolution with numerous parallel paths, each aligning with a particular component of an organization's operations, culture, and strategic objectives.

Between these two extremes, organizations progress through different stages as they understand and acknowledge the potential of hyperautomation, define a centralized team for implementing automation, decentralize delivery, and establish an integration strategy and governance of the overall process. (Interviewee A, Levels 2-4; Interviewee B, Levels 1-5; Interviewee H, Automation Incubator & Enterprise Scaler; Interviewee D, Levels 1-3; Interviewee J, Stages 2-5).

Technologies play a significant role at higher maturity levels with the inclusion of multiple interconnected technologies that constitute the hyperautomation toolbox and the organization's ability to collaborate with these technologies. (Interviewee B, Level 5; Interviewee E, Principle 5; Interviewee E; Interviewee G, Hyperautomation Expansion Stage & Advanced Maturity Stage; Interviewee B, Integration Stage & Digital Processes Stage).

Additionally, corporate culture and business-IT collaboration play a crucial role in the development of hyperautomation maturity by fostering creativity, ongoing learning, and even the acceptance of failure as a necessary component of the experimentation process (Interviewee E, Principle 6; Interviewee B, Culture of Innovation Stage & IT-Business Partnership Stage).

Interviewee I points to the Gartner Integration Maturity Model, which has parallels with the hyperautomation journey. This model starts with no strategic thought given to integration and extends to a stage where the integration strategy is perpetually evolving, focusing on business enablement and ongoing enhancement, and integration is viewed as a widespread, cross-organizational skill involving both internal business partners and frequently, external ones too.

From these responses, we see a broad pattern of stages that emerge:

Awareness and Enlightenment: Organizations first need to understand what hyperautomation is, why it's valuable, and how it could potentially benefit their processes. This stage is crucial as it forms the basis for the organization's decision to adopt hyperautomation.

Research and Experimentation: Organizations begin to research and experiment with the technology. Some business cases are made for further development and the necessary environments for experimentation are put in place.

Implementation and Centralization: As organizations gain experience, they begin to implement projects and appoint a central responsibility for enterprise automation.

Decentralization and Democratization: As specifically said by Interviewee J and mentioned by others, after understanding that enterprise automation cannot be centralized, the delivery model is distributed under the governance and supervision of a central authority. Workgroup levels can leverage automation technology and there may be citizen developers.

Interconnection of Technologies and Autonomous Enterprise: Organizations begin using multiple interconnected technologies from the hyperautomation toolbox and aim for autonomous enterprises. AI tools are utilized to make data-driven decisions and therefore the organization can stay ahead in the industry. There is a smooth collaboration between customers, businesses, and technology.

Culture of Innovation: The final stage is characterized by a culture of innovation and continuous learning where hyperautomation is integrated into the organization's culture, everyone has an understanding of hyperautomation and constantly looking for opportunities. The organization can utilize multiple technologies and the scope of automation is broadened across the organization

By leveraging these insights from our interviewees and drawing parallels with Gartner's Integration Maturity Model, we have developed the Hyperautomation Maturity Model which is displayed and detailed in Section 5 Hyperautomation Maturity Model Design.

5. Hyperautomation Maturity Model Design

In this section, we will go over the Hyperautomation Maturity Model (HMM), how we addressed the insights from the literature review and exploratory interviews, the dimensions of the model, the characteristics of each level, and guidelines for transitioning between levels.

5.1. Hyperautomation Maturity Model

Each of the five dimensions should be assessed to determine an organization's overall maturity. By doing this, an organization can identify the key areas to focus on allocating their resources to get the most value.

Examine the total levels across the five dimensions to determine an organization's overall maturity stage. The majority of dimensions must be at or above that level to advance through maturity stages; no dimension can be more than one level below the overall stage. (see Figure 8: Hyperautomation Maturity Model)

	GETTING STARTED			STANDARDIZATION		AUTONOMOUS ENTERPRISE
	AD HOC	ENLIGHTENED	EXPERIMENTATION	SYSTEMATIC	COLLABORATIVE	SELF-SERVICE
STRATEGY	"WHY SHOULD WE BOTHER ABOUT HYPERAUTOMATION"	Hyperautomation is seen as a potentially useful discipline, but there is limited understanding	The reason and value behind hyperautomation has been recognized by the management	Hyperautomation Is Recognized As a Needed Approach	Hyperautomation capabilities are distributed	Hyperautomation is embeded in to the organization's culture
OWNERSHIP	No structured approach No defined responsibility	No Defined Responsibility, ownership is project based	Loosely defined point of responsibility, ownership is project based	EAT formally owns all hyperautomation responsibility	EAT enables projects to own integration responsibilities	Fully distributed
DELIVERY	No formal methodology or structured approach	There is no formal delivery unit, Project based	There is Pilot Team is responsible for the delivery of first business cases	Centralized	Empowered, decentralized	Democratized
TECHNOLOGY	Technologies are utilized purely on case-by-case basis	Value behing collaborating multiple technologies is recognized	Partnerships are made and necessary technologies and tools for hyperautomation have been acquired	EAT selects which technologies to be addopted, Technology stack is managed by central team	EAT is branched for each technology, shared tools and frameworks supported by EAT	Supports self-service for multiple personas
OPERATIONS	Siloed or non-existent	Siloed or non-existent	Non-standardized and fragmented	EAT defines standards and centrally controls	Common shared standards. Distributed infrastructure	Collaborative

Figure 8: Hyperautomation Maturity Model

By using the guidance given in Section 5.5, organizations can determine their current maturity stage of the functional area primarily engaged within hyperautomation.

5.2. Creation of the Model

As a result of our research, we created the HMM which is based on Gartner's Integration Maturity Model. We have broadened the scope of the Integration

Maturity Model so that organizations can use our model for not just integration but also the combination of different technologies that function as automation, decision-making, and reporting.

We identified that IMM through its levels is scaling from having no awareness about the technology and capabilities to being fully compliant and digitizing the company culture. Interviewee I's company, being one of the users, partially supports the statement that the model fits as a solution for hyperautomation. However, hyperautomation captures the broader scope rather than just one technology as we detailed in the section 2.5.2 Integration Maturity Model. Therefore we determined that modification is necessary for it to address the hyperautomation requirements and challenges, we gave a more in-depth analysis in the Literature Review section (see 2.5 Existing Maturity Models).

5.3. Five Dimensions of the Model

In this section, we will go over the dimensions of the model and summarize the aspects which are being addressed in the hyperautomation journey with justifications.

Five Dimensions	Summary
STRATEGY	What is the awareness of hyperautomation as an approach/mindset within the organization?
OWNERSHIP	Who defines standards and policies for how hyperautomation should be adopted?
DELIVERY	Who is responsbile for building hyperautomation capabilities?
TECHNOLOGY	Which technologies and tools will be adopted for hyperautomation use-cases?
OPERATIONS	Who manages hyperautomation instances and how is insights into their operation used?

Table 5: Summary of Five Dimensions

5.3.1. Strategy:

Every interviewee acknowledges the importance of awareness and understanding of hyperautomation as a necessity in the hyperautomation journey. Interviewee A, for instance, mentioned the first two stages he gave which were the 'No Awareness' and 'Experiment and Research' stages where necessary knowledge is gained in the organization for experimenting and identification of possible business cases. Similarly, Interviewee J also spoke about the stages of 'No Awareness' and 'Enlightened', where the organizations understand the value and importance of hyperautomation.

Also in IMM, the strategy behind adopting integration incrementally grows as the organization realizes the necessity for integration and it becomes part of the company culture. Overall these responses highlighted the importance of strategic recognition and understanding of hyperautomation as a crucial step, therefore reinforcing the reasons for having 'Strategy' as a dimension of the Hyperautomation Maturity Model.

5.3.2. Ownership:

The concept of ownership is visible in every interview we had, and the impact ownership has on the success of hyperautomation. Interviewees A, B, C, F, G, I, and J specifically mentioned the formation of a Center of Excellence (CoE), they highlighted the need for a central authority for defining standards and best practices for enabling the company to create value from the adopted technology. We also identified that the need for clear ownership and governance is one of the success factors for a successful implementation of hyperautomation as it has been given as a key success factor in 6 different interviews, aligning with the 'Ownership' dimension of the Model.

5.3.3. Delivery:

The maturity in the delivery is another important theme. To automatize the organization, the delivery of such capabilities is certainly a must. We see that required maturity increases as the project complexity and automation scope broaden.

Moreover, expanding capabilities to a larger number of processes and teams, as mentioned by Interviewee D in the 'Scaling Up' stage, is a clear indication of a maturing delivery dimension. This expansion demonstrates an organization's readiness to move beyond pilot projects and apply hyperautomation in a wider context, reflecting a maturing delivery mechanism that is capable of handling an increased scale and complexity. The aspect of scale and distribution is also visible in Interviewee J's 'Centralized', 'Decentralized', and 'Democratized' stages. This evolution signifies a maturity in recognizing the need for a more inclusive, accessible, and flexible delivery system in hyperautomation. Considering these, the delivery aspect of hyperautomation is not only an important indicator but also a key driver for its ongoing evolution and success.

5.3.4. Technology:

The importance of selecting and integrating the right technology stack and tools for hyperautomation was highlighted in every interview. Also in the definition of hyperautomation, we see that the combination of multiple technologies is one of the characteristics of hyperautomation. For instance, interviewees A, B and C, F, G speak about different stages where multiple technologies from the hyperautomation toolbox are deployed and connected. Interviewee E specifically pointed out that it is a necessity to create value from AI tools like ML, Deep Learning, etc., to stay ahead of the industry. These all support the reasons for adding the 'Technology' dimensions to our model.

5.3.5. Operations:

The operation is also one of the mentioned aspects of hyperautomation, the need to efficiently manage and monitor the hyperautomation operations. The interviews which supported the need for a central team that should be responsible for hyperautomation ventures also highlighted the need for structured monitoring and analyzing. Also, Interviewee D mentioned the need of comprehensive planning is necessary to avoid overwhelming the hyperautomation team and the rest of the

organization. Together are support the value behind the ‘Operations’ dimension of the model.

5.4. Stages of the Model

In this section, we will go over the stages of the hyperautomation journey and briefly detail each stage.

5.4.1. Ad Hoc

‘Ad Hoc’ is the first stage of the hyperautomation journey, in this stage the company's overall knowledge and awareness of hyperautomation are almost non-existent, they are just at the beginning of adopting the approach. Although the organization is just starting with hyperautomation, they may have pre-existing teams that have built capabilities with automation technologies but generally, these technologies are adopted project by project and there isn’t a specific team responsible for governing these built capabilities. The company has a siloed structure, even if there are specific teams responsible for each technology(e.g. RPA team, Process mining team, etc.), these teams are not collaborating, departments consult these teams independently and ask for a certain capability to be built using their technology, there is no specified responsible who guides the business on selecting the right technology for their need.

5.4.2. Enlightened

‘Enlightened’ is the second stage of the hyperautomation journey, in this stage overall organization is still not aware of hyperautomation but there are some ‘champions’ within the organization that are aware of the value behind hyperautomation and they are promoting the hyperautomation approach to be adopted. There isn’t any change between levels 1 and 2 in terms of the organizational structure, siloed structure still exists. There is internal communication within the organization about which technologies could be beneficial for the company to adopt.

Evaluating whether our organization possesses the requisite in-house expertise for this transition is a critical step. Consequently, the organization considers if partnering with an external entity could provide valuable guidance and support. Therefore organizations start to communicate with consultancy firms and technology vendors to gain more knowledge. For some firms, a ‘Proof of Concept’ is built at this level to demonstrate the feasibility and practical potential of the technology to the management.

5.4.3. Experimentation

‘Experimentation’ is the third stage of the hyperautomation journey, in this stage we see that management has recognized the reason and value behind the hyperautomation approach and supports this transformation. Necessary agreements with partners and technology vendors are made, meaning initial investments are done at this stage. The organization is aware that the siloed structure is an obstacle to grow, therefore the organization has formed a cross-functional 'pilot team'. This team, comprising members from various departments, is tasked with spearheading

the initial projects. Their collective insights, drawn from diverse operational areas, will ensure a more holistic and integrated approach to hyperautomation. If the necessary experience is not available in-house to identify the overall requirements, the hyperautomation partner guides the organization to identify and address them.

Some experience in implementing adopted technologies is being developed at this stage, also successes, challenges, and lessons learned are being documented. The organization is aware that the siloed structure is a problem and they are taking the first initial step with this pilot team. While the hyperautomation partner continues to provide guidance and support, the organization also begins to upskill its employees, building the necessary in-house expertise that will be crucial for the sustainability of the hyperautomation journey.

As the experimentation phase progresses, the organization will have a clearer understanding of the benefits, costs, and potential hurdles associated with hyperautomation. This knowledge will provide a more solid foundation for the next steps on the journey.

5.4.4. Systematic

'Systematic' is the fourth stage of the hyperautomation journey, in this stage, we see that hyperautomation is recognized as a needed approach with the firm. The firm recognizes the complexity of managing and scaling hyperautomation capabilities across the organization. At this stage, organizations centralize the responsibility of hyperautomation to optimize the technology portfolio and build up critical mass in terms of skills. The pilot team grew as the Enterprise Automation Team (EAT).

Hyperautomation is centrally delivered by the EAT which is fully in charge of the strategy, this includes selecting the appropriate set of tools. The EAT also acts as an "enterprise automation factory", meaning that when local teams have an issue to tackle, they "outsource" the implementation of the needed capabilities to the EAT. The local teams define what they need and the EAT provides the solutions. At this point, hyperautomation is only being delivered by the EAT, meaning they are also responsible for maintaining consistent security, compliance, and quality of service policies across the implementations they make, they have full control over hyperautomation innovations. Since the knowledge is gathered on one team, the siloed approach to building capabilities is effectively dismantled.

5.4.5. Collaborative

'Collaborative' is the fifth stage of the hyperautomation journey, in this stage, we see that hyperautomation capabilities are being distributed into different delivery units. After seeing the quick growth of EAT, meaning a significant number of available developers and capabilities are spread across business units, the team leads to recognize the need to branch out for each technology they are providing services. For example, an EAT delivering and supporting the projects for RPA, AI, and Process Mining recognizes that they need to divide these technologies into branches which will still be governed by the EAT. So at this point, EAT becomes more of a business enabler, business units consult the EAT with the business case they have, and EAT determines which solution is the best fit for the problem and escalates the project to the responsible delivery unit. All of the delivery units are still connected to the EAT,

they comply with the rules and standards determined by the EAT, and every project is still monitored and governed by the EAT.

5.4.6. Self-Service

'Self-Service' is the sixth and final stage of the hyperautomation journey. At this stage, hyperautomation has become fully embedded into the company culture, influencing how decisions are made.

The key unique characteristic of the 'Self-Service' stage includes reduced human involvement in day-to-day operations, the expansion of automation's scope organization-wide, and the extension of hyperautomation delivery capabilities to a wider range of authorized users. Empowered by the Enterprise Automation Team's standards and best practices, these users can implement their hyperautomation solutions. This can take the form of 'Fusion Teams' or 'Citizen Developers.'

The concept of 'Fusion Teams,' as described by Gartner (Gupta, 2022), is particularly relevant. These are multidisciplinary teams that gather digital talent from different areas of the business, as well as the formal IT organization. They are organized to digitalize business capabilities, delivering technological solutions for specific business or customer outcomes. In the context of hyperautomation, these fusion teams can work independently but are still under the governance of the Enterprise Automation Team. Fusion teams implement hyperautomation solutions tailored to their unique operational contexts and business needs.

On the other hand, there are the Citizen developers, who are non-technical end-users trained to build or maintain their hyperautomation solutions. This approach to hyperautomation delivery allows for faster, more localized responses to automation needs and creates an environment that encourages innovative problem-solving (Liptak & Horwitz, 2021).

However, it's important to note that this stage can be challenging to achieve in real-world scenarios. Achieving a 'Self-Service' level of maturity requires not only considerable technological and process knowledge but also a cultural shift towards ownership, autonomy, and cross-disciplinary collaboration. It requires that organizations have an established hyperautomation infrastructure, strong governance practices, a culture of continuous learning and adaptation, and the ability to manage the inherent complexities and risks associated with democratizing hyperautomation capabilities. It necessitates a level of trust in the skills and judgment of non-technical personnel and their adherence to set standards and best practices.

Despite these challenges, the 'Self-Service' stage represents the pinnacle of hyperautomation maturity, where organizations can maximize the benefits of hyperautomation and drive continuous innovation and improvement.

The following guidelines can be used to assess the maturity level of the hyperautomation across the organization. It details the characteristics of each dimension across different stages of the hyperautomation journey.

5.5. Characteristics of stages per dimension

In this section, we will go over each level and provide context for every dimension's characteristics per stage. These characteristics are made with the intention for organizations to identify where they stand in terms of their hyperautomation maturity.

Strategy

Level	Characteristics
1	There is not strategic thought given to hyperautomation. In most cases, the IT organization does not recognize hyperautomation as an independent discipline. The organization may be using automation in some form, but it's uncoordinated.
2	Hyperautomation is seen as a potentially useful discipline, but there is limited understanding or consensus about its value. There may be sporadic or ad hoc attempts at implementing hyperautomation, but these efforts are not coordinated or part of a larger strategic plan. There may be some champions within the organization who understand the benefits and are advocating for a more systematic approach, but this has not yet been adopted as the organization's standard practice. The organization's available technologies are operating in silos, leading to a lack of alignment among the functional teams.
3	The value and reason behind hyperautomation are recognized by IT leaders; however, the organization takes an opportunistic, project-by-project approach to building hyperautomation capabilities. There's a growing awareness among functional teams about the necessity and benefits of evolving into cross-functional entities.
4	Hyperautomation is a recognized approach within the organization. Hyperautomation strategy and approaches are defined, managed, and governed with the help of a formally defined Enterprise Automation Team.
5	The Enterprise Automation Team has become a critical digital business enabler. This team defines and governs hyperautomation strategy and which technologies to adopt. Business critical projects remain centralized, but the Enterprise Automation Team also proactively facilitates decentralized application delivery teams for each adopted technology.
6	There is a constant push to evolve the hyperautomation strategy with a focus on enabling business and continuous effort to improve best practices, processes, and skills by collaborating with all the internal and external hyperautomation stakeholders. The organization's digital proficiency bolsters a rapid, strategic integration of new technologies, exploiting its established digital capabilities.

Table 6: Stages and Characteristics of Strategy

Ownership

Level	Characteristics
1	There is no structured approach to hyperautomation and no defined responsibility for ensuring that hyperautomation is implemented consistently. Competencies and technologies are sourced case by case
2	IT may have defined some guidance on how hyperautomation should be approached; however, ownership remains project-based with no formal governance.
3	There might be a loosely defined point of responsibility or group within the organization that is starting to guide the automation efforts. Automation technology and competencies are still often sourced case by case, but there may be early efforts to consolidate knowledge and resources. However, a formalized governance structure for overseeing and implementing automation is still lacking, and ownership of individual projects remains decentralized.
4	An Enterprise Automation Team formally manages hyperautomation. This team centrally supports and fulfills requirements emerging across the organization.
5	The Enterprise Automation Team provides frameworks and tools in a coherent, integrated, shared, centrally governed, and managed service that covers multiple scenarios and supports centralized and decentralized delivery via well-defined governance processes.
6	Hyperautomation is embedded in the organization's digital culture and is business-aligned. The collaborative capabilities are in place. The Enterprise Automation Team ensures that hyperautomation is seen as a cross-organizational approach.

Table 7: Stages and Characteristics of Ownership

Delivery

Level	Characteristics
1	Hyperautomation is typically implemented ad hoc by application or project teams or occasionally by business users with no formal governance or standardization on how to approach automation requirements, leading to inconsistent implementation and support.
2	There may be a recognition that hyperautomation challenges differ from generic development requirements; however, delivery is the responsibility of the project. There is no formal process for addressing hyperautomation outside of the project team.
3	There is a shift towards a more coordinated approach, with some standardized practices beginning to emerge, although these may not be consistently applied across all projects. Some elements of governance might be introduced, but it's still largely project-based. There may be early efforts to centralize delivery under a specific team or entity, but this process is still in its initial stages and not fully formed.
4	Delivery is centralized under the Enterprise Automation Team. Enterprise Automation Team defines and promotes best practices, patterns, standardized processes, reusable artifacts, and guidelines that specialists in the Enterprise Automation Team leverage using the selected set of tools and technologies.
5	The Enterprise Automation Team delivers a flexiable and adaptive approach in place to support rapid hyperautomation requirements by supporting delivery in a decentralized fashion where technologies have separated delivery units but are still bound by the Enterprise Automation Team.
6	The Enterprise Automation Team extends the organization's capabilities as needed so all authorized users are empowered to deliver their own hyperautomation solutions following enterprise-wide standards and approaches and are supported with hyperautomation capabilities provided via persona-specific self-service user experience.

Table 8: Stages and Characteristics of Delivery

Technology

Level	Characteristics
1	Hyperautomation requirements are addressed without following any formally defined or consistent approach. Even if there is the needed technology stack for hyperautomation, they are siloed and not collaborating.
2	Management has recognized The value behind collaborating multiple technologies to address hyperautomation problems. If technologies and tools are not present within the company, in this stage, those are being selected. Communications with vendors and partners are being made.
3	Partnerships are determined, and necessary technologies and tools for hyperautomation have been acquired. These technologies start to be integrated and coordinated to address hyperautomation challenges more effectively. There's an early-stage effort to standardize technology choices across different projects and to manage them centrally.
4	The organization dedicates financial and human resources to define and centrally support hyperautomation approaches under the control of the Enterprise Automation Team. Enterprise Automation Team determines which technologies should be adopted to support their hyperautomation journey.
5	The Enterprise Automation Team defines which technologies to be adopted in the organization, and the team is branched within itself for each technology in order to support users. They select frameworks and/or tools to address both systematic requirements and adaptive requirements that enable a wider community of users.
6	The Enterprise Automation Team team implements, maintains, and evolves full-function, multipersona, self-service hyperautomation capabilities. The team actively trains, mentors, and supports users of the hyperautomation capabilities on an ongoing basis.

Table 9: Stages and Characteristics of Technology

Operations

Level	Characteristics
1	There is no process for monitoring or managing hyperautomation separately from applications.
2	Operational and management features built into hyperautomation tools may be used for essential functioning and performance, but there is no overall operational approach or team dedicated to hyperautomation.
3	There's a growing recognition of the need to manage and monitor hyperautomation separately from other applications. Some basic processes or systems may be implemented for this purpose, although they are still not fully developed or consistently applied. Hyperautomation is still managed by project or application teams, but there's an emerging trend toward centralization.
4	Hyperautomation is deployed and managed centrally, separate to applications. Business and system monitoring of hyperautomation is done by Enterprise Automation Team.
5	Decentralized teams for each technology manage the common shared infrastructure through the business with alignment to the hyperautomation strategy empowerment team. There is clear alignment between high-level organizational and corporate goals with continuous widescale monitoring of appropriate metrics, KPIs, and Service Level Agreements
6	There is Proactive monitoring in place. Automation and observability tools are implemented throughout every system, enabling comprehensive alerting and analysis.

Table 10: Stages and Characteristics of Operations

5.6. Scaling through maturity stages

In this section, we will provide actionable guidance to scale through each maturity level.

Transitioning from Level 1 to Level 2:

- **Build Awareness:** Have discussions about the potential, use cases, and benefits of hyperautomation. Include strategic considerations, highlighting the long-term benefits to the organization.
- **Expertise and Ownership Identification:** Identify whether you have in-house expertise for hyperautomation projects, and determine which external partners you need to collaborate with. As well as deciding whether to hire or train employees, consider the formation of a team or designation of specific individuals to oversee hyperautomation implementation.
- **Stakeholder Buy-In:** Gain leadership support by presenting potential ROIs and the ability of hyperautomation to solve existing business problems and deliver business benefits.
- **Preliminary Delivery and Operations**: Initiate low-risk automation projects. Standardize and monitor their implementation.
- **Technology Selection:** Start selecting appropriate technologies and ensure they have the potential to be integrated effectively.

Transitioning from Level 2 to Level 3:

- **Enhanced Strategy:** Refine your understanding of the value of hyperautomation and start introducing strategic initiatives to implement it more widely.
- **Ownership Expansion:** Form an Enterprise Automation Team. They will align hyperautomation initiatives with business strategy and ensure governance.
- **Improved Delivery:** Implement hyperautomation in a controlled setting with clearly defined objectives and performance indicators. Begin training personnel to manage hyperautomation projects.
- **Process Analysis and Operations:** Identify processes suitable for automation and start assessing their complexity and potential benefits. Make sure to monitor these processes separately.
- **Scalable Technology:** Build an integrated tech stack for hyperautomation and ensure that your infrastructure is ready for scaling.

Transitioning from Level 3 to Level 4:

- **Strategic Evolution:** Make hyperautomation a recognized approach within your organization. Let the Enterprise Automation Team manage and govern your hyperautomation strategy.

- **Centralized Ownership:** Have the Enterprise Automation Team centrally manage hyperautomation, supporting requirements from across the organization.
- **Standardized Delivery:** Centrally handle delivery under the Enterprise Automation Team. Start defining and promoting best practices, patterns, and standardized processes.
- **Operational Overhaul:** Transition towards centralized management and monitoring of hyperautomation separate from other applications.
- **Integrated Technology:** Dedicate resources to centrally support hyperautomation. Determine which technologies should be adopted.

Transitioning from Level 4 to Level 5:

- **Strategic Decentralization:** Allow the Enterprise Automation Team to facilitate decentralized application delivery, while maintaining centralization for business-critical projects.
- **Ownership Framework:** Have the Enterprise Automation Team provide frameworks and tools that are integrated, shared, and governed centrally.
- **Flexible Delivery:** Support rapid hyperautomation requirements via a flexible and adaptive delivery approach.
- **Decentralized Operations:** Let decentralized teams manage shared infrastructure, with alignment to the hyperautomation strategy.
- **Expanded Technology:** Branch the Enterprise Automation Team to support individual technologies and select tools to address both systematic and adaptive requirements.

Transitioning from Level 5 to Level 6:

- **Constant Strategic Evolution:** Continually evolve your hyperautomation strategy, with a focus on enabling the business and improving best practices, processes, and skills.
- **Business-Aligned Ownership:** Embed hyperautomation in your organization's culture and ensured it's seen as a cross-organizational approach.
- **Empowered Delivery:** Enable all authorized users to deliver their hyperautomation solutions, following enterprise-wide standards and approaches.
- **Proactive Operations:** Implement proactive monitoring throughout every system, enabling comprehensive alerting and analysis.

- **Technology Mentorship:** Implement, maintain, and evolve full-function, multi-persona, self-service hyperautomation capabilities. Train, mentor, and support users on an ongoing basis.

6. Model Evaluation

To evaluate the Hyperautomation Maturity Model, we conducted confirmatory interviews with experts. These interviews aimed to assess whether our model can effectively capture the nuances and complexities of an organization's hyperautomation journey and whether it can provide valuable guidance to support strategic decision-making.

6.1. Structure of the evaluation

The evaluation consisted of a series of semi-structured interviews with each participant. Before the interviews, the experts were provided with detailed information about the model (Figure 8: Hyperautomation Maturity Model), its dimensions (Table 5), its various stages and characteristics (Table 6,7,8,9,10), and the steps to progress through the levels (Section 5.6). This allowed the experts to develop a broad understanding of the HMM and its intended use.

During each interview, we presented the HMM in detail, ensuring that every element was fully explained. Afterward, we solicited initial feedback and impressions from the experts. Following this, we provided a questionnaire designed to assess the HMM based on the following six key criteria: usefulness, ease of use, subjective norm, compatibility, intention to use, and voluntariness.

Each criterion was assessed using 2 to 3 quantitative questions on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The criteria were defined as follows:

Usefulness: The degree to which the Hyperautomation Maturity Model (HMM) enhances an organization's progress, and strategy formulation in hyperautomation.

Ease of Use: The perceived effortlessness associated with understanding and applying the stages and criteria defined in the HMM.

Subjective Norm: The level of acceptance of the HMM among various stakeholders within and outside an organization in comparison to other model.

Compatibility: The degree of alignment between the HMM and an organization's existing processes, practices, and objectives in hyperautomation.

Intention to Use: The willingness of an organization to adopt and utilize the HMM in planning and assessing hyperautomation initiatives.

Voluntariness: The degree to which the use of the HMM is perceived as optional or mandatory within an organization.

In addition to the defined criteria, our evaluation strategy included open-ended questions that allowed experts to provide additional insights and feedback on the HMM. This qualitative approach enabled us to capture rich, unique perspectives on the model's real-world applicability, strengths, and potential areas for improvement.

The following section will provide an overview of the results from the confirmatory interviews.

6.2. Results

In this section, we will present and discuss the findings we gathered from the confirmatory interviews. We interviewed 5 of the interviewees from the exploratory interviews, which are Interviewees A, C, D, I, and G. Due to time constraints, we were not able to broaden our interviewee pool. The results presented in this section are based on the collected feedback from the interviewees and questionnaires completed by these experts.

Findings cover the main six criteria we mentioned in the previous section, which are usefulness, ease of use, subjective norm, compatibility, intention to use, and voluntariness. For each of these criteria, we will present an average score, calculated from the Likert scale ratings, followed by interpretation and discussion of the insights from the interviews. The questionnaire is available in the section Appendix: HMM Evaluation Questionnaire

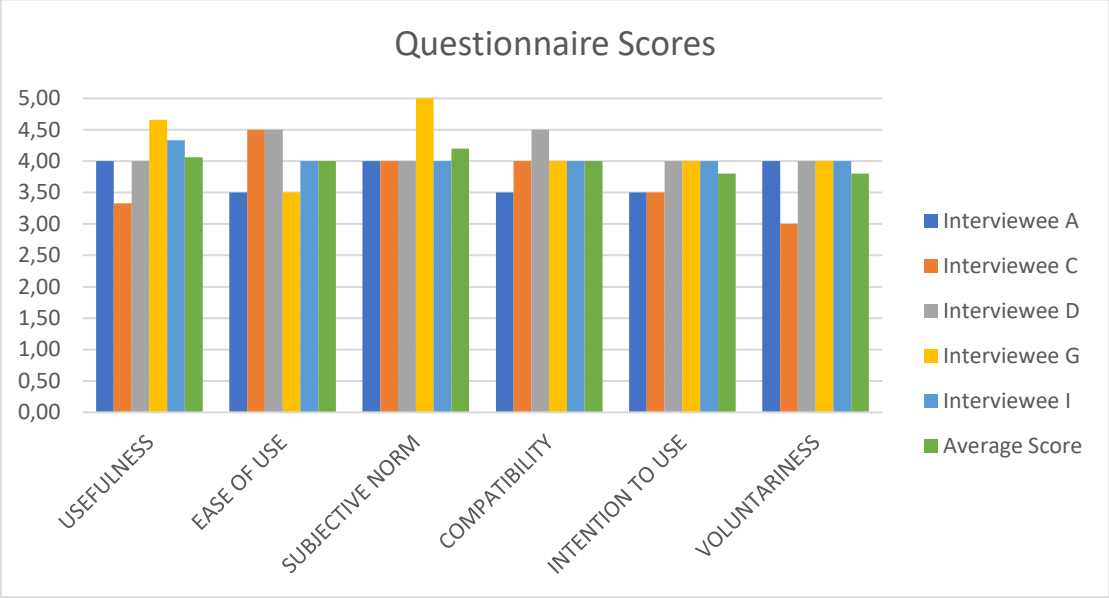

Figure 9: Scores given by interviewees in the questionnaire

6.2.1. Usefulness

The usefulness of the model got an average rating of 4.0/5, reflecting that the model is able to achieve its goal, effectively guiding an organization's strategy and progress to achieve higher maturity in hyperautomation.

Interviewee D made the point that 'The model is very complete. It would be applicable for any technology implementation, not just hyperautomation.', this means that we were able to capture the essence of hyperautomation that it is not about only one technology but also the technologies that later can be part of the hyperautomation technology stack. Additionally, Interviewee J mentioned that the overall journey given in the model is very applicable to real-life scenarios as

currently, most organizations are following the given path to achieve higher maturity in hyperautomation.

However, specific areas could be improved in the model. Interviewee C noted that the model does not include risk considerations. In the interview with interviewee C, he mentioned that as organizations scale their hyperautomation teams, complexity would increase with it as well and it may impact the organization and create challenges.

Interviewee G commented ' The model is very useful. The only thing that is missing is a questionnaire to evaluate the current level.', from this comment we understand that developing an assessment questionnaire for determining the maturity level could be a potential upgrade to the model.

Summary: Overall, the usefulness of the model was acknowledged by the interviewees, with an appreciation for its applicability to various technologies and real-life scenarios. The inclusion of risk considerations and an assessment questionnaire emerged as suggested areas for enhancement.

6.2.2. Ease of use

The ease of use of the model got an average rating of 4.0/5, interviewees found the model very straightforward and well-structured as they mentioned in the interviews.

There was a point made clear by interviewees A, C, and D that the model was hard to understand for someone who has limited knowledge about hyperautomation.

As we mentioned in Section 6.1 Structure of the Evaluation, the interviewees were provided with Figure 8: Hyperautomation Maturity Model, Table 5, Table 6,7,8,9,10, and information given in Section 5.6. They were not provided with any additional information as provided in this research paper. Interviewees suggested an enhancement in its storytelling aspect is needed if the model is going to be used for real-life practices, Interviewee A said 'It is really helpful but needs a little bit more of story telling', Interviewee C said 'Storytelling could be better, but besides that, the model provides a clear overview of the journey and requirements' and Interviewee D said 'The model document can use some voice-over / an introduction page'.

Summary: The model was generally perceived as straightforward and well-structured. Yet, improving the way it is communicated or presented to individuals with limited hyperautomation knowledge emerged as a potential improvement therefore an introduction page is suggested.

6.2.3. Subjective norm

The subjective norm of the model got an average rating of 4.2/5, the interviewees were overall pleased with how the model compared to similar models.

Interestingly, we saw that some of the interviewees were not using any model in their daily routines when working with their clients, Interviewee D commented '…in practice, these models are only found in theory books, which are rarely used in daily enterprise life unfortunately, therefore it's hard for me to picture a standard to compare it against', we also saw that in the exploratory interviews that consultants

we interviewed were relying on their knowledge and experience when working with a client rather than relying on a model. Additionally, interview

Interviewee I, whose organization was using the Integration Maturity Model by Gartner as the ‘map’ for the hyperautomation journey, stated that ‘ The only competitor for the HMM currently is Integration Maturity Model by Gartner, I believe that this model is a step up comparing to that model in the context of hyperautomation since it is focused on hyperautomation and the corresponding technologies’, showing that the model was able to meet the standards of a maturity model.

Interviewee A also commented, ‘What you see is that most companies are at stage 3 or even 4. This model is something that might help companies mature even more. I hear within the industry that most companies are looking at something similar to this HMM’ which further supports that the model was able to meet the expectations and standards.

Summary: Most interviewees found the model comparable or superior to existing models, even if such models are not regularly utilized in their practice. The model was seen to meet the standards and expectations of the hyperautomation industry.

6.2.4. Compatibility

The compatibility of the model got an average rating of 4.0/5, showing there is an alignment with an organization's existing processes and objectives in terms of hyperautomation.

Interviewee A commented ‘ I think levels 1 to 5 are nice and possible to achieve. Level 5 to 6 sounds really good but seems difficult to achieve, level 6 also has the potential to go back to silos if not done correctly ‘.

Interviewee D mentioned ‘ It is not as much compatibility, but focus. Introducing hyperautomation within companies is often successful, but rarely reaches maturities higher than 3-4 given in the model. Once the overall business goals are met, or at least met enough the focus shifts to other necessities in the enterprise. This often stalls further growth in maturity.’

Interviewees C and I commented that the model will suit most situations and organizations, and also stated that the model was compatible with the scaling objectives of the organization's hyperautomation initiatives.

Summary: While most stages of the model were recognized as achievable and aligned with existing processes, some concerns were raised about the difficulty of successfully growing throughout the journey and the potential risks that come with reaching the highest maturity level.

6.2.5. Intention to use

The intention to use scored an average of 3.8/5, indicating a strong inclination among the experts to implement the model in their hyperautomation initiatives planning and assessment.

Interviewee C stated ‘When I am deployed within an organization for advising or supporting the client's automation strategy this model could be a useful tool, but in my place as a developer it is not’, meaning that the role is an important factor for who will more inclined towards using the model.

Another point made is that the intention to use depends on the organization's goal regarding hyperautomation, Interviewee G mentioned ‘I think it’s suitable in most situations. It all depends on the ambitions of the client/organization to scale. If they don’t embrace automation as a strategy and stay as a siloed initiative then they shouldn’t use the model.’ Additionally, Interviewee D mentioned that ‘Even before the creation of this model, a lot of the common practices mentioned are already part of our advice in introducing hyperautomation to companies. Reasons for deviating from this model are simple: the customers' wishes. More than often we advise starting on this journey, but time and/or budget constraints customer side will limit it to just introducing a single automation for their immediate needs. While you can still state the model is applied just stopped at level 1, it can’t be explained as an implementation of this model ‘.

Interviewee A made the point that the model could be a great tool for showing organizations what the situation will be like if the organizations are fully committed to the hyperautomation, he commented ‘I think it is really nice to explain the different stages of the Hyperautomation journey’.

Summary: Despite variations depending on the role and goals of the user, there was a strong intention among interviewees to implement the model in their hyperautomation initiatives.

6.2.6. Voluntariness

Voluntariness achieved an average rating of 3.8/5. Experts suggested that adopting the HMM should be optional, yet vital for organizations aspiring for higher hyperautomation maturity levels. The decision to adopt should ideally be guided by strategic goals and the perceived hyperautomation value.

Interviewee I commented ‘…the model is especially beneficial for low-maturity organizations since the model provides a well-structured roadmap and gives a pretty good idea of how the future looks like with hyperautomation. For higher maturity companies like my current company, I believe it would still be beneficial and I would support the decision to adopt the model.’

Interviewee C stated ‘If it is required to use the framework I will use it, but it depends on which role I have within a company’.

Interviewee D commented ‘…the model largely complies with our existing way of working so I think it is a good model, though few surprises or groundbreaking innovations in it. It is a lot of common sense (which I like) put together in a model. I would be very open to using the model with my clients.’

Summary: Adoption of the HMM is viewed as beneficial but should not be mandatory, the decision should ideally guided by strategic objectives and the

perceived value of hyperautomation. Despite this, the majority of experts expressed a willingness to use the model in their practice.

7. Discussion

In this section, we will discuss the results and the methodology we have used in the research. It will tackle the possible threats to the validity and the limitations of the study, including the lessons learned from the research and the potential impact.

7.1. Threats and limitations

This part of the section delves into various potential threats to the authenticity and possible restrictions of our study.

7.1.1. Expert bias

Expert bias is a risk in our research due to conducting interviews, where the findings we had relied heavily on the insights of chosen experts. Since the results are dependent on their understanding and perceptions of the model, there's a possibility that their personal bias could alter our results. We needed to minimize this factor during the exploratory interviews.

We have predetermined a set of structured questions to guide each interview. By doing so we were able to create a certain consistency across interviews which reduces the opportunity of individual biases to lead the direction of the conversation. Additionally, we had the flexibility to ask follow-up questions if new and interesting information came up during the interviews. This approach allowed us to dig deeper into topics that emerged organically during the conversations, and limit personal bias in our results

7.1.2. A limited number of interviewees

The limited number of interviewees is another constraint in our methodology that might have impacted the results. We had the opportunity to evaluate the model with only five interviewees, therefore our findings might not fully represent the views and opinions of all experts in the field of hyperautomation. Expanding the number of interviewees could have offered a more comprehensive understanding of the HMM and its application in real-world scenarios.

7.1.3. Lack of real-life validation

Our methodology primarily focused on theoretical analysis and expert opinions, lacking empirical evidence from real-life applications of the model. Real-life validation could have provided more evidence to prove the model's effectiveness and highlighted practical challenges that might not have been captured in a theoretical framework or through expert opinions. Due to these factors, our results contained some limitations.

To validate the methodology more accurately and gather richer data, case studies could be applied to assess the HMM, which will be an important layer for future research for our study

7.2. Potential Impact

Although the main output of this research is the development and evaluation of the Hyperautomation Maturity Model, the research could contribute much more than that.

By introducing a structured and measurable way to evaluate and guide organizations' hyperautomation maturity, we provided the opportunity for them to adopt hyperautomation as a core approach and strategically accelerate their hyperautomation journey. With the introduction of the five dimensions in section 5.3 Five Dimensions of the Model, organizations would now be able to pinpoint areas of improvement to strategically transform their business. As stated in numerous research reports (Bhatt, Nihit;, 2019; Edlich, Alex; Phalin, Greg; Jogani, Rahil; Kaniyar, Sanjay, 2019; Richard Bergman, 2021; Suresh Sambandam, 2021) and as defined in the 1.2 Research problem, organizations were struggling to find the right approach to implement automation further in their organizations. We believe that with the introduction of HMM, this problem is now addressed.

We have seen in section 2.1 Definitions of Hyperautomation, that there are numerous definitions of hyperautomation given by technology providers, which we believe is creating confusion among organizations eager to digitize and automate their operations via hyperautomation. By analyzing the public and the expert definitions we think that now we have crafted a more comprehensive understanding that not only clarifies the concept but also shapes the hyperautomation landscape by:

- **Reducing implementation barriers:** With a clearer understanding, the decision-making process for organizations would be accelerated.
- **Aligning stakeholder vision:** By providing a standardized definition, stakeholders within an organization can have a unified vision that eliminates inefficiencies.
- **Encouraging vendor consistency:** With a clearer benchmark, technology providers can better align their services with market needs.

Additionally, while conducting the literature review for our research, we struggled to find academic literature on the subject. This shortage could be due to hyperautomation being a very new term or its predominant focus as a hands-on technique, which perhaps overshadowed its theoretical exploration in academia. We believe that our research will pave the way for future research in this field, proving that even a highly applied approach like hyperautomation has significant academic value. We firmly believe that we created value for academia, as the research fills a knowledge gap in academia, lays down a conceptual framework, and acts as a reference point for future research.

From a practical standpoint, our model could help consultants, technology leaders, and managers in assessing their organization's hyperautomation maturity and designing a roadmap for progress. The model acts as a barometer to gauge an organization’s standing in the hyperautomation journey. By using the model they can create a roadmap tailored to their needs as the model allows them to set clear and achievable milestones. Moreover, it could also aid vendors and service providers in understanding their client's needs better, thus facilitating more aligned and effective solutions. This not only augments the relationship between client and customer but also fosters clearer communication.

However, these contributions are speculative at this stage and would need to be validated through further research and practical application of the model.

8. Conclusion

In this section, we will conclude our research by revisiting our research problem, answers to the research questions, and overall contributions we made and suggestions for further research.

Our study aims to address the challenges faced by organizations in implementing and scaling hyperautomation. As highlighted in numerous reports the complexity of the work involved, lack of understanding of the technology landscape, and absence of a clear roadmap have led to a significant number of failures in hyperautomation initiatives (Bhatt, Nihit;, 2019; Edlich, Alex; Phalin, Greg; Jogani, Rahil; Kaniyar, Sanjay, 2019; Richard Bergman, 2021; Suresh Sambandam, 2021), which is also discussed in the section 1.2 Research Problem and 1.3 Research aim and objectives. To tackle these issues we aimed to develop a model which organizations can use as a guide to implement the hyperautomation approach.

We started by identifying the research questions (1.4 Research Questions) that would guide our investigation into hyperautomation. These questions were designed to provide a comprehensive understanding of hyperautomation, from general concepts to specific implementation stages and dimensions that organizations need to mature to scale their capabilities. By addressing these questions, we aimed to design the Hyperautomation Maturity Model.

For answering these research questions we relied on the available information given on hyperautomation but we struggled to fully address our questions by using only the available literature. Therefore we conducted exploratory interviews with experts in the field to have a deeper understanding of hyperautomation and processes behind the approach. By doing so we were able to find answers to our research questions.

8.1. Answers to the Research Questions

Research Questions 1 – What is Hyperautomation

When we research the meaning of hyperautomation, we first consider the definition given by Gartner (Ray, Guttridge, Vincent, & Karamouzis, 2021) defines it as a business-focused, disciplined approach used by organizations to automate as many business and IT processes as quickly as possible. At the same time, it emphasizes that hyperautomation involves the regular use of multiple technologies, tools, or platforms.

In all the interviews we conducted, we see that this definition is widely accepted, but every interviewee has added their thoughts on top of the given definition. We noticed that the views of experts were divided into two perspectives; one side views it from a technology perspective while the other side views it from a business perspective.

While designing our model, we took both perspectives into account and realized that the mindset of automating all processes within the company goes hand in hand with the idea of using multiple technologies together. We determined that the existence of one leads to the formation of the other, and without one, the other cannot be established. As the scope of automation grows within an organization it becomes a necessity to make use of multiple technologies since one technology or tool would not fit every business case.

However, we would especially like to note that based on our research, as Gartner also mentioned, hyperautomation is a business-driven discipline. Therefore, how much the management endorses this discipline within the company is highly important for the success of the hyperautomation initiative. (Refer to 2.1 Definitions of Hyperautomation & 4.3 Hyperautomation definition according to interviewees for details)

Research Questions 1.1 – What are the common definitions?

Adding on to the information given for Research Question 1, our dive into the common definitions of hyperautomation revealed some interesting findings. The definition provided by Gartner stands out as a benchmark in the industry, frequently referred to and acknowledged by various experts.

However, beyond Gartner's perspective, there are other nuances to how hyperautomation is perceived. From our interviews and literature reviews, several recurring themes and definitions surfaced which we have discussed in section 4.3 Hyperautomation definition according to interviewees.

Research Questions 1.2 – What business goals do organizations try to achieve with the use of Hyperautomation?

To understand the main motivations behind the reason for adopting hyperautomation we needed to understand the business values organizations aim to achieve. Through our extensive literature review and expert interviews, it became clear that organizations aim for numerous types of objectives when turning to hyperautomation. The potential benefits we have identified are listed below, details have been discussed in section 2.2 The potential benefits of Hyperautomation.

1. **Enhancing Process Efficiency**
2. **Empowering Rapid Adaptation and Innovation**
3. **Augmenting Employee Engagement**
4. **Augmenting Return on Investment (ROI**
5. **Empower IT through Seamless Integrations**

To conclude, the decision to adopt hyperautomation is not driven by a single goal. Instead, organizations see it as a multidimensional solution that promises not only operational excellence but also innovation, employee satisfaction, financial gains, and seamless IT operations. The benefits we discussed in section 2.2 offer a deeper

dive into these motivations and the extensive advantages hyperautomation brings to the table.

Research Questions 1.3 – What are the most common technologies?

We have seen that numerous technologies are involved in hyperautomation, some technologies are more popular than others. We have seen both in literature and interviews that making use of technologies is key and we have elaborated in the previous sections (see 2.3 Involved Technologies & 4.4 Hyperautomation technology toolbox according to interviewees).

Currently, the discussed technologies are the most utilized technologies and tools for implementing hyperautomation, but we want to highlight that in the future these technologies can change and new technologies could be part of the hyperautomation toolbox.

Research Questions 2 – What are the stages of hyperautomation implementation?

To understand the journey organizations are going through in adopting hyperautomation, we identified that they navigate through unique stages. We detailed the stages in the previous sections and involved them in our Hyperautomation Maturity Model (5.4 Stages of the Model). We can describe the stages organizations typically follow as below:

1. **Ad Hoc**: (Refer to section 5.4.1 Ad Hoc)
2. **Enlightened**: (Refer to section 5.4.2 Enlightened)
3. **Experimentation**: (Refer to section 5.4.3 Experimentation)
4. **Systematic**: (Refer to section 5.4.4 Systematic)
5. **Collaborative**: (Refer to section 5.4.5 Collaborative)
6. **Self-Service**: (Refer to section 5.4.6 Self-Service)

This framework, from the Ad Hoc phase to Self-Service, provides a roadmap for organizations on the stages of hyperautomation, emphasizing the importance of transformation, governance, and collaboration.

Research Questions 3 – What are the dimensions that organizations need to mature to scale their hyperautomation capabilities?

Understanding that hyperautomation is a complex and organization-wide discipline, there are multiple dimensions that organizations need to mature to grow their capabilities. We have described these dimensions and given the reasoning behind them previously in section 5.3 Five Dimensions of the Model.

The identification of these five dimensions was drawn from the patterns we identified in the interviews and the Integration Maturity Model by Gartner. In essence, while both hyperautomation and integration models share core concepts around strategy, ownership, delivery, technology, and operations, hyperautomation has distinctions that revolve around broader automation technologies and

organization-wide involvement. The IMM serves as a foundation, yet hyperautomation demands further changes to capture its comprehensive essence.

1. **Strategy** (see section 5.3.1 Strategy and Table 6)
2. **Ownership** (see section 5.3.2 Ownership and Table 7)
3. **Delivery** (see section 5.3.3 Delivery and Table 8)
4. **Technology** (see section 5.3.4 Technology and Table 9)
5. **Operations** (see section 5.3.5 Operations and Table 10)

Strategy, Ownership, Delivery, Technology, and Operations emerged as the key dimensions that organizations need to mature to successfully scale their hyperautomation implementations. By going over section 5 Hyperautomation Maturity Model Design, organizations can make improvements tailored to their unique business environment.

8.2. Contributions

In this section, we have listed the contributions that we have made during this research.

Comprehensive Hyperautomation Roadmap: The research has led to the development of the Hyperautomation Maturity Model, which provides a holistic roadmap and guidelines for adopting hyperautomation as an approach. By drawing insights from expert interviews and a comprehensive literature review, we offer a structured path to grow hyperautomation capabilities.

Enhancement of Existing Principles and Practices: We have seen that various principles, practices, and frameworks like Integration Maturity Model are used by organizations for hyperautomation, we have augmented these standards by integrating expert opinions and real-life experiences. Therefore a much richer and more actionable framework is displayed for organizations to implement hyperautomation efficiently and effectively.

Identification of Common Definitions: A challenge in the hyperautomation landscape has been the vagueness of terminologies and definitions. We have analyzed the most common definitions and provided a comprehensive perspective on understanding hyperautomation to give more clarity on the topic.

Exploration of Business Goals: By analyzing the strategic reasons behind the hyperautomation, we highlighted the majority of the business goals organizations are aiming to achieve. From operational efficiency to enhanced customer experiences, we've mapped out hyperautomation benefits and desired business goals, providing businesses with a clear rationale for their investments in hyperautomation.

Analysis of Common Technologies: Hyperautomation consists of integrating multiple technologies. In this research, we have explored these technologies and highlighted their unique features and applications. This analysis aids organizations in making informed decisions when adopting new technologies, ensuring that they can leverage the right tools for their specific needs.

Identifying Opportunities for Future Research:

The last contribution of our research is the establishment of a foundation for hyperautomation in the academic world. By identifying gaps in the hyperautomation landscape and in our research we have given opportunities for future practitioners and scholars to improve and expand upon our work.

8.3. Future Research

In this section, we will go over some of the points that we believe need deeper exploration and could be important for the refinement of the Hyperautomation Maturity Model.

Real-life validation of the model

As we also mentioned in the Discussion section, the lack of real-life validation of the model is one of our limitations within the research. As we focused on theoretical analysis and expert opinion to evaluate the model, the results lacked empirical evidence from real-life applications of the model. By testing the model with companies we believe that further improvement points could be identified.

Addition of the 'Data' dimensions to the model

Throughout the paper, we have highlighted the importance of AI and machine learning for hyperautomation and results in the significance of data as an important component. While we believe that maturing across the five dimensions guides the organization's approach to data, the model currently lacks explicit guidelines to encompass the methodologies, technologies, and governance required to harness data effectively for hyperautomation. Therefore we think that the addition of the 'Data' dimension could significantly improve the model.

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10. Appendix

Interview Questions:

1. What is your academic background in terms of formal education?
2. How many years of experience do you have in the field of automation?
3. What is hyperautomation?
4. What are the technologies involved in the hyperautomation approach? a. -Which ones are you using commonly, and why?
5. What are the profiles of the clients that you are working with?
6. Any similarities between clients? (Common issues, lack of any attribute, etc.)
7. What is your approach when a client wants to implement hyperautomation?
8. How do you determine the right solution for a client?
9. How do the solutions you present differ from solution to solution? a. Can you give examples?
10. How would you specify your clients in terms of their organizational maturity?
11. What are the organizational attributes that highly affect your ability to implement automation solutions with ease?
12. How do you establish governance in your solutions? a. What is your main priority?
b. How do you comply with the client's procedures?
13. How would you describe the stages of the hyperautomation journey?
14. What makes a company mature for automation implementations? a. Which dimensions need to be developed to gain maturity?
15. How would you describe the quality of the solutions you provide? a. Do you measure this?
b. If not, how could you measure this?
16. What are the success factors for implementing hyperautomation?
17. What are the most common challenges you are facing? And how do you overcome them?
18. Are you available for follow-up questions?

Hyperautomation definitions according to interviewees:

Interviewee	Emphasis	Quote
A	The approach of combining multiple technologies to automatize business processes	"Hyperautomation is the use of multiple technologies, combined, so not only RPA, so RPA is more to where you have a legacy and you don't have APIs, interact with those kinds of things. But also for example, process mining, to find your process and to capture the things which are on your screen, but also like low-code to create new apps or if it's too complex to go to legacy coding and all that and artificial intelligence, NLP, which is part of artificial intelligence and intelligent document processing. So all this combined, that's for me hyperautomation, that's how I like to call it intelligent process automation. And not looking at technology, not looking at the restrictions just combining what you have disposable, interlinking it together to have like full enterprise automation."
B	Replacing Manual tasks with the use of technologies	"There's a very simplistic definition, it is RPA plus one of the additional technologies like machine learning and or artificial intelligence combined with process mining. However, I also would like to give it a more elaborate definition which is hyperautomation is the automation that is required to go from analog business processes to digital business processes. Right now the focus is much more on converting analog into digital and not so much which is the true final objective is creating new business processes based on technologies which are machine learning, artificial intelligence, and automation so robot process automation is one of the subsets of automation. And machine learning. That's it."
C	The approach to achieve full enterprise automation (automate everything within a business)	"My definition of hyperautomation is to automate processes. Start from the start till the end within a company not specified on specific processes but the whole primary business process as it stands."
D	Is an advanced, non-invasive automation approach that builds upon existing IT infrastructure, automating tasks traditionally performed by humans, and enhancing business processes by leveraging technologies like AI and RPA.	" So where you have your traditional automation using classic application or web services or integrations etc. Hyperautomation focuses more on automation on top of the automation you have in your existing IT software landscape. And to that, you add more business-accessible forms of automation which have a shorter time to markets and add value where classic IT could not anymore. "

E	Hyperautomation is a strategic, future-oriented approach that employs a toolbox of varied technologies to solve specific problems, aiming to enhance human capabilities, automate processes, optimize efficiency, and add significant value across an organization.	It's more like a mindset. It's more like an approach. For me, it's not like, if you have RPA and you add AI and you have hyperautomation. That's not the case for me. It's using the best technology for the right case to create a solution that fits the problem and it's creating a toolbox of technologies for end-to-end automation. That's creating more opportunities, with a toolbox that you have consisting of different tools that you can use to automate or make the process more efficient.
F	A strategy of utilizing multiple technologies collaboratively, instead of focusing on a single tool, to automate end-to-end processes, thereby improving the overall efficiency of the organization.	It is using, not focusing on one tool specific, but looking at processes end to end and using different tools, the best tools, to automate the process. So instead of looking at the process and like we're going to put out, we're going to use RPA to automate the process. No looking at the end-to-end process and in that process you might see sub-processes that can be automated using different technologies because for some processes used in RPA, it's ridiculous. It won't work. It's not the best case. You might need AI or you might need to connect data through APIs, because if there's an API why we should make a robot? Mm-hmm. So looking at the whole whole end to end process. And automate that using all kinds of different technologies and not only that, those technologies work together. So you have, an RPA robot that at the end of this process sends its data to an API. That data is retrieved in a recently built low-code application and then it's sent to an AI that makes some decisions and goes back to the robot. So the whole stream of multiple technologies works together to automate the end-to-end process or better yet automate your organization.
G	Combining technologies to automate as fast as possible	So for hyperautomation, for me it was started as a definition for the combination of multiple technologies. Now it's more like a framework. How can we use all kinds of technologies to automate as much processes as fast as possible?
H	Hyperautomation is a mindset or approach that aims to identify, assess, and optimize as many business and IT processes as possible through the strategic use of any IT solutions that help digitize and automate parts of those processes.	To me, automation is an approach, a mindset. that companies and people within companies need to have to identify, assess, and eventually automate and optimize as many business and IT processes as possible and I think it most important part for for me is that it's about an an approach, a way of thinking, and it's not about any of those individual technologies because you speak to people about automation. And that don't have technical backgrounds. One person is depending on the jobs you do, but one person could think about automation. For me, it's really some technology that helps me dive in for instead of doing it myself, but for another person who is responsible for financial analysis automation is an analytic solution. It's about the approach. It's not about the technology.
I	Is the advanced utilization of various automation technologies like RPA, process mining, OCR, BPM, APIs, and	Hyperautomation for me is using different technologies for making something faster, more efficient, cheaper, you name it.

	chatbots, driven by business needs, to enhance efficiency and speed.	
J	is an approach using various technologies and methodologies to automate as many organizational processes as possible, aiming for efficiency, business agility, innovation, enhanced user experiences, and real-time situational awareness.	Hyperautomation is a set of technologies and methodologies and approaches to help organization by automate as much as they possibly can. So in other words, the idea of hyperautomation is that, in order to liberate resources, reduce costs etc. you want to automate as much as possible in your organization. Of course you need to have a priorities etc. but the approach is let's automate as much as we possibly can so that we can reduce our cost, be more efficient and liberate human resources and use those human resources in more creative work jobs than automating mundane and repetitive tasks.

Table 11: Interview results for the definition of Hyperautomation

Interviewee A:

Maturity Levels	Definitions	Requirements
0	No Awareness	
1	Experiment and Research	There is some knowledge within the organization and necessary environments are inplace for experimentation with the technology. Some of the business cases are made for further development.
2	Some Automations in Place	Firstly defined projects are up and running, now the organization has the experience on the analysis/development/maintance of an automation project
3	Automation in Pipeliness with Visualizations	The COE (Center of Excellence) is in place, best practices, standards and governance procedures are defined. Organizations is able to orchestrate and manage their projects with the guidance of COE. Value of the capability is being promoted within the company
4	Automatic Deployments with Full CI/CD environments	A CI/CD pipeline automates your software delivery process. The pipeline builds code, runs tests (CI), and safely deploys a new version of the application (CD). Automated pipelines remove manual errors, provide standardized feedback loops to developers, and enable fast product iterations.
5	Having Multiples Interconnected Technologies from the Hyperautomation Toolbox	There are multiple technologies that are intact, such as Low Code, No code, AI branches, etc...
6	Autonomous Enterprise	Collaboration between Customer, Business, and Technology,

Interviewee B:

Maturity Levels	Stage	Definition
1	POC and Individual Platforms Stage	This is the beginning phase where businesses start with simple proofs of concept (POCs) or individual automation platforms, such as Robotic Process Automation (RPA).
2	Integration Stage:	As the organizations grow more confident and competent, they start integrating different components. This may include combining AI models with robots or other automated processes. This requires considerations around security, data, and benefits, and the integration process begins to gather steam.
3	Digital Processes Stage	In this stage, more new digital processes are being built from scratch, indicating that the company is almost at the end phase of the hyperautomation journey.
4	IT-Business Partnership Stage	Here, IT is building the solutions, but they're not the ones designing it. Business needs to be able to think of the automation solutions, indicating a mature IT-business partnership.
5	Organizational Maturity Stage	At this level, a significant number of people within the company have knowledge about hyperautomation. There might be a subset of citizen developers who understand the technology and can work with it.
6	Culture of Innovation Stage	The company culture allows for failure and experimentation, and business decisions aren't driven solely by business cases. This stage represents a significant maturity level where the organization has a well-embedded culture of innovation and continuous learning.

Interviewee C:

Maturity Levels	Stage	Definition
1	Process Mining	Companies that have enough capital might choose to invest first in process mining. This stage involves getting deep insights into business processes to make them more efficient.
2	RPA and BI Stage	If process mining is not feasible or affordable, companies might choose to start with RPA or Business Intelligence (BI). RPA is easy to develop, cost-efficient, and provides measurable cash savings. BI, on the other hand, can increase the knowledge about business processes within the company.
3	Hyperautomation Expansion Stage	As companies begin to understand their processes better and have some level of automation in place, they may start thinking about expanding their automation capabilities. They might invest in more sophisticated automation tools or technologies.
4	Centre of Excellence Stage	Here, IT is building the solutions, but they're not the ones designing it. Business needs to be able to think of the automation solutions, indicating a mature IT-business partnership.
5	Organizational Maturity Stage	At this stage, a company would have automated a significant portion of their processes and would be looking to further increase their knowledge and capabilities in automation to reach the next level.

Interviewee D:

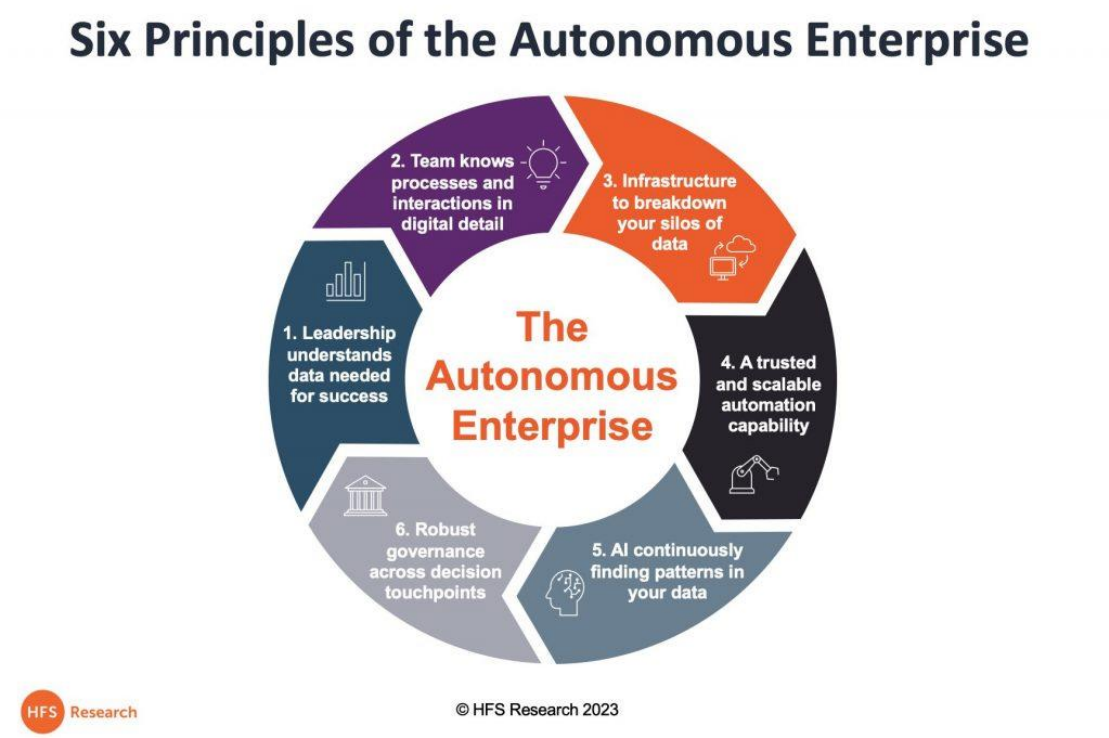
Maturity Levels	Stage	Definition
0	Pilot	Begin with a small-scale, experimental application of hyperautomation technologies.
1	Definition	Identify what needs to be in place (infrastructure, standards, etc.) before the organization can scale up its hyperautomation efforts.
2	Implementation	Put in place the necessary infrastructure and standards for scaling hyperautomation.
4	Scaling Up	Expand hyperautomation to more processes within a single team (volume), involve more segments of the organization (breadth), and start using additional technologies within the hyperautomation suite (depth).

With addition to the levels, interviewee D has highlighted three different dimensions to be focused in order to scale the hyperautomation capabilities across the organization, those dimensions are:

1. Developing more processes within the same team
2. Involving other department/teams processes
3. Involving other technologies to the technology stack

Interviewee E:

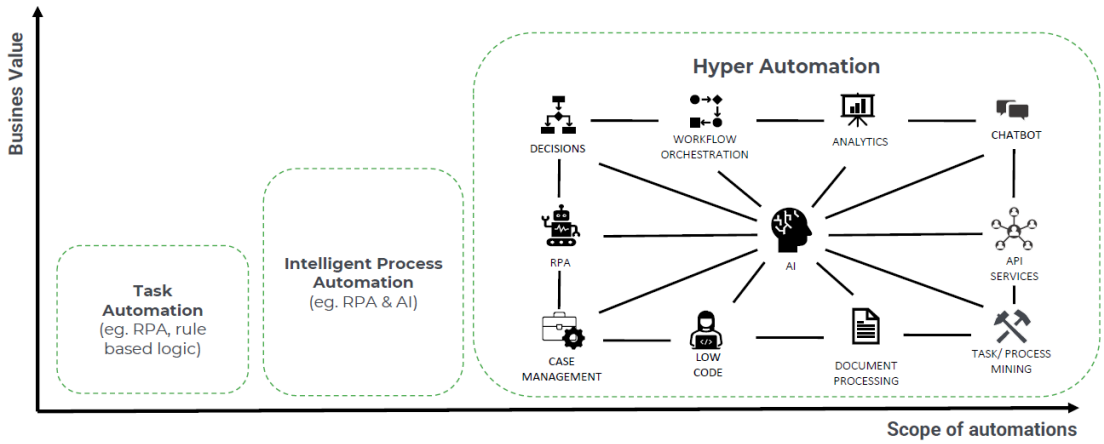
Interviewee E has provided us the Six Principles of Autonomous Enterprise pushlished by HFS Research (Fersht, Diaz, & Cushman, 2023) when we asked for the stages of hyperautomation. This entails six fundamental tenets that need to be embraced to enhance the autonomous capabilities of an enterprise within its business ecosystem and adjacent networks



1. The leaders in organization must have a thorough understanding of the vital data necessary for the success of your business.
2. It's essential that organizations teams have a deep knowledge of your business's digital processes and interactions, and maintain an up-to-date audit log of these activities.
3. The right infrastructure should be in place to eliminate data silos throughout organization and its associated ecosystem.
4. Organization should guarantee a dependable and scalable automation framework that earns trust from both internal and external stakeholders.
5. The enterprise must leverage Artificial Intelligence tools, such as Machine Learning, Deep Learning, and decision-making engines, to continually discern patterns in your data, thereby staying ahead in your industry.
6. It's crucial to implement a solid governance system across all decision-making points to validate the efficacy of your autonomous enterprise.

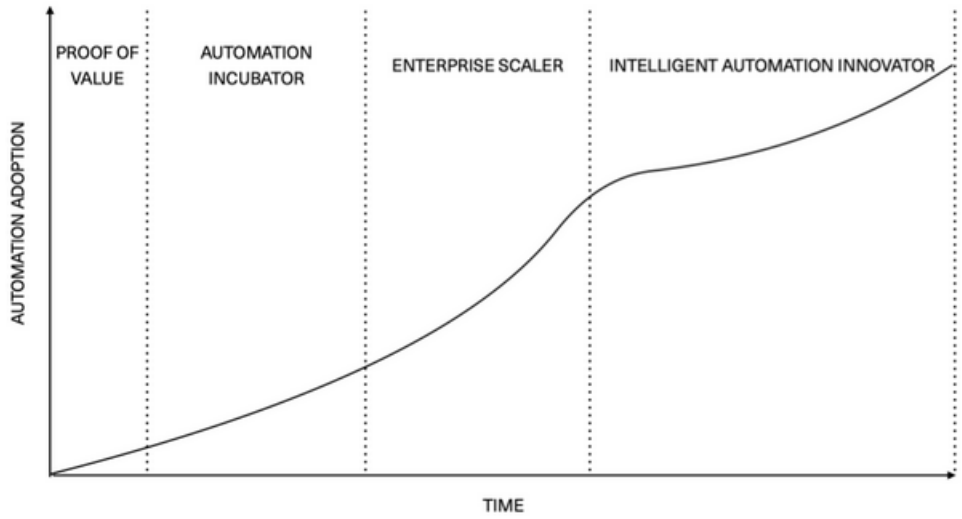
Interviewee F & G:

Interviewee F and G has taken 2 dimensions when it comes to stages of hyperautomation, business value and scope of automations.



They pointed out that as the scope of automation grows the need to collaborate multiple technologies become inevitable and that is what he defines as hyperautomation as well. He especially underlined AI as the key technology to use when it comes to achieving hyperautomation.

Interviewee H:



Proof of Value

· Create a demonstrable proof of value that resonates with key stakeholders

· Understand the key steps to successfully implement our first automation

· Understand automation technology and the partner landscape to support our journey

· Formalize support to establish an automation capability

Automation Incubator

· Create a foundational operational automation capability

· Set up a supporting PMO to track and manage performance

· Build a high-performance team

· Establish the automation technology platform and supporting partners

· Engage stakeholders to generate awareness and build an automation backlog

Enterprise Scaler

· Extend our communications strategy to support enterprise-wide engagement

· Mature our delivery processes to support scale

· Establish delivery governance across multiple enterprise functions

· Identify intelligent automation complementary technology partners and successfully execute localized proofs of value

· Align to the corporate level challenges and digital evolution strategy

· Actively promote performance to board level

Intelligent Automation Innovator

· Align the intelligent automation strategy to enable the organization's digital evolution program

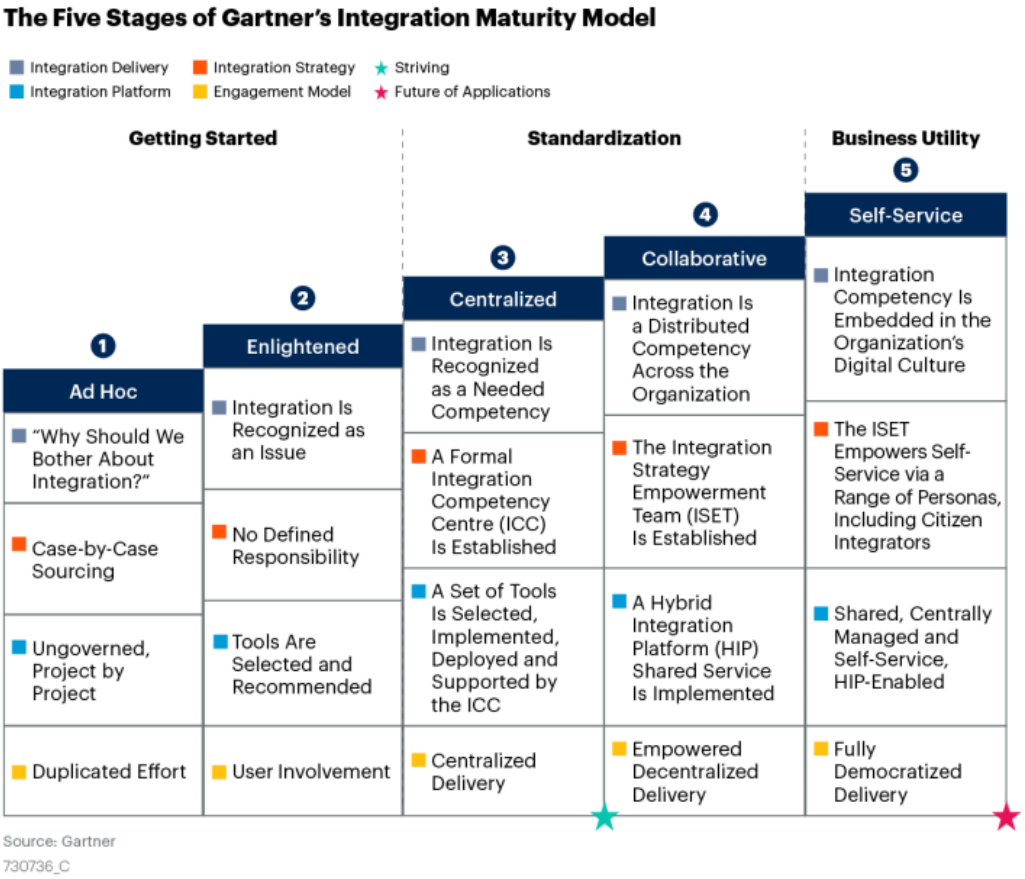
· Demonstrate strategic value contribution through the delivery of integrated intelligent automation solutions

· Systematically increase the intelligent automation technology portfolio

· Create an innovation-centered integrated intelligent automation team

· Extend enterprise engagement to support strategic intelligent automation-driven change

Interviewee I:



Interviewee J:

Maturity Levels	Stage	Definition
1	No awareness	No idea about the reason and value of implementing hyperautomation
2	Enlightened	Understands the reason and oppourtunities on adopting hyperautomation
3	Centralized	Appoint a responsiblity formaly responsible for enterprise autoamtion, delivery model is centralized, a central team delivering automation to everybody (CoE etc...)
4	Decentralized	Understanding enterprise automation cannot be centralized, there is one responsible for hyperautomation strategy, but the delivery is distributed under the governance and supervision of central authority
5	Democritized	In addition to previous levels, workgroup level is able to leverage automation technology, citizen developers etc.

HMM Evaluation Questionnaire:

The following questionnaire is made for assessing the Hyperautomation Maturity Model. For each question, respondents should select from the options.

Name and Surname:	

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Usefulness					
The Hyperautomation Maturity Model is instrumental in evaluating our organization's progress and proficiency in hyperautomation					
Implementing this model could significantly contribute to the success of our hyperautomation initiatives					
This model can effectively guide our organization in formulating and streamlining our hyperautomation strategies.					
What do you think about the overall usefulness of the HMM?					
Ease of Use					
The stages and criteria defined in the Hyperautomation Maturity Model are easy to understand and apply					
The Hyperautomation Maturity Model offers clear, actionable guidance for growing hyperautomation capabilities.					
What do you think about the overall ease of use of the HMM?					
Subjective Norm					
The Hyperautomation Maturity Model meets the standards expected of a model designed for assessing hyperautomation maturity.					
I would advocate for the adoption of the Hyperautomation Maturity Model among my peers and other organizations dealing with hyperautomation.					
How do you think the HMM compares to other models or standards for assessing hyperautomation maturity that is prevalent in your industry?					
Compatibility					
The Hyperautomation Maturity Model provides a suitable framework for planning the scaling of our hyperautomation capabilities.					
The principles and stages defined in the Hyperautomation Maturity Model are congruent with the scaling objectives of our organization's hyperautomation initiatives.					

What do you think about the overall compatibility of the HMM?					
Intention to Use					
Based on my experience, I intend to employ the Hyperautomation Maturity Model regularly in planning and assessing our hyperautomation strategy and implementations.					
There are a few circumstances or situations in which I would choose not to use this model for assessing hyperautomation maturity.					
In which situations do you think HMM will achieve its purpose, and in which situations it will not?					
Voluntariness					
I would proactively choose to use the Hyperautomation Maturity Model, even in the absence of an explicit requirement to do so.					
Even if my organization did not officially adopt the Hyperautomation Maturity Model, I would consider using its principles to guide my work.					
What are your overall thoughts on being willing to use the model?					
Additional Comments:					