STRATEGIC MANAGEMENT FOR THE SUCCESSFUL DIGITAL TRANSFORMATION OF INDUSTRIAL AUTOMATION COMPANIES

by

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Chair

DEDICATION

THIS DISSERTATION IS DEDICATED TO ALL INDUSTRIAL AUTOMATION PROFESSIONALS

ACKNOWLEDGMENTS

This dissertation comprises vital knowledge and information on digital transformation driving factors, action fields, maturity levels, digital technologies, and success factors pertaining to industrial automation (IA) companies. The dissertation makes a valuable contribution by formulating digital transformation strategic management for IA companies. The knowledge has percolated from the chief executive officers, chief digital officers, directors, project managers, leaders, and earnest work done by previous scholars. The researcher would like to acknowledge the support of some people without whom this dissertation would not have been completed.

First, the researcher would like to convey his profound gratitude and deepest regards to Dr. Iva Buljubasic for her constant encouragement, unrelenting coaching, and moral guidance, which made completing this research possible. Her perceptive criticism and valuable suggestions were of immense help. Working with her was such a pleasant and excellent learning experience.

The researcher is grateful to his wife and children, who were the most significant sources of inspiration throughout the DBA journey and dissertation preparation.

Besides, the researcher would like to thank colleagues, professionals, and friends who shared their time and effort to complete the interviews and questionnaire survey, without which this research would be incomplete.

Abstract

The role of information technology has become critical in globalized business and day-to-day life. Digital transformation impacts all segments of industries and the business world, like manufacturing, retail markets, healthcare, real estate, and education. Industrial automation (IA) companies known as pioneers of industry 3.0 are not immune to this new disruption. IA companies are under pressure of twofold transformation: they must undergo internal operation transformation and support their client's transformation journeys in the manufacturing and process industries. However, digital transformation is complex; many organizations spend millions only to hit roadblocks. This research explores and understands how some organizations successfully implemented digital transformation while others still struggle. The fundamental question is: "What are the factors and strategies for successful implementation?" The researcher has analyzed the data collected through a literature review and interviews with executives and leaders. This research has identified the driving factors, required action fields, and critical success factors of the digital transformation pertaining to industrial automation (IA) companies. The research aim is to formulate a digital transformation strategic management plan for industrial automation (IA) companies. Given the requirement for in-depth insight from the practitioners and leaders, a qualitative method was adopted to collect and analyze the data. Semi-structured interviews with 16 professionals were used for data collection and then analyzed using content analysis for interference and conclusion. Developed strategic management is expected to help IA companies successfully implement digital transformation and sustain its benefits.

KEYWORDS

Strategies, Transformation, Leadership mindset, Digital mindset, Industrial Automation, Drivers, Success factors. Action Fields, Digital Maturity, Waterfall Project Management, Agile Project Management, SPOT.

LIST OF ABBREVIATIONS

AI: Artificial Intelligence

APM: Agile Project Management

BCG: Boston Consulting Company

CAGR: Compound Annual Growth Rate

CEO: Chief Executive Officer

CIO: Chief Information Officer

CSO: Chief Strategic Officer

DX: Digital Transformation

IPMA: International Project Management Association

IT: Information Technology

FAT: Factory Acceptance Test

ML: Machine Learning

PMI: Project management Institute

TPM: Traditional Project Management

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1 CHAPTER 1: AN INTRODUCTION TO STUDY

This introductory chapter identifies a critical element of the thesis, including the background statement, research problems, research aim and objectives, research questions, research methodology, scope and limitation of the study, beneficiaries of the study, and structure of the thesis. This chapter helps to understand; how the research is performed and what factors motivated the researcher on this subject. It gives a glimpse and idea of the entire thesis.

The thesis discusses the need for digital transformation for industrial automation (IA) companies and identifies the factors for successful implementation. The thesis formulates the strategic management plan to guide IA companies from the exploration phase of transformation through implementation, sustainability, and continuous improvement.

Digital transformation has caused disruption (Albukhitan, 2020) and a tsunami of uncertainties in the global business world (Kontic and Vidicki, 2018). Some renowned organizations perished as they failed to compete in the digital era. The bankruptcy of the movie-rental company Blockbuster and the sale of the Washington Post to Amazon are examples that demonstrate the negative impact of not transforming. Simultaneously, digital transformation offers enormous opportunities and benefits to companies and leaders who act fast. Companies like Larsen & Toubro in India and Amazon succeeded in the business by adopting digital transformation. Digital transformation opens new technology and business horizons (Schaede, 2020). Transformation is vital for the survival and success of industries and businesses (Ramnarayan and Mehta, 2020). Digital transformation is a top priority in the CEO's strategic planning list. As per the CIO.com survey, 40% of the spending on technology will go toward digital transformations (figure 1).

Figure 1: Digital Transformation Spending (CIO.com, 2014, cited in Yokogawa, 2021)

Industrial automation companies like Honeywell, Yokogawa, Emerson, GE automation, and Rockwell are impacted by digital transformation (Hess et al., 2016). Industrial automation companies are under pressure for internal transformation and to enable the transformation of manufacturing and process industries, such as oil and gas, refineries, chemicals, LNG plants, etc.

Process industries like oil and gas, refineries, petrochemical, and chemical industries have operational constraints due to fluctuating commodity prices, stringent environmental regulations, and an experienced aging workforce. These organizations are looking towards IA companies and tech industries to help them improve operational efficiency and transform their businesses.

IA companies thus have the responsibility of both internal and external transformation. Internally, IA companies must transform their engineering, human resource, manufacturing, and logistics; to become cost-effective and work towards creating a value proposition for the customers. Externally, IA company should support the manufacturing and process industries' transformation journey.

1.1 Background to the Research Study

Many companies have endeavored digital transformations, only to hit roadblocks. Only a few organizations in the world are genuinely digitally mature. Google, Amazon, and

Facebook are some examples of digitally matured companies. The failure of digital transformation ranges from 66% to 88% (Libert, Beck, and Wind, 2016; Saldana, 2019). It raises the question of why the digital transformation strategy failed and the causes behind it. The research analysis pinpoints strategic management factors like misalignment between business strategy and goal, leadership, resource competency, culture, and businesses needing to be customer-centric (Davenport and Westerman, 2018). Blake (2019) reported that companies like GE and Ford managed to adjust their strategy in the initial phase and succeeded at a later stage. Various studies reveal no dearth of research studies focused on industrial automation companies' digital transformation. In general, professionals investigated digital transformation in collaboration with consultants like Deloitte and Mckinsey (Gill and VanBoskirk, 2016; Kane et al., 2015). Since this is still an evolving field, very little academic work is conducted to help practitioners (Vukšić et al., 2018; Henriette et al., 2016).

Organization leaders in the last two decades gained experience in strategic implementation. Baroto et al. (2014) argue that strategy execution is less precise than strategy formulation, and Jofre (2011) agrees that implementing a strategy is more complicated than formulating one. For digital transformation, all components of strategy: formulation, implementation, and sustaining play a critical role; transformation is a continuous journey.

The present research aims to study digital transformation in industrial automation. This research will identify the critical success factors and formulate the strategy for implementing digital transformation in industrial automation companies.

1.1 Research Problem

A staggering 70% of digital transformation initiatives have failed (Saldanha, 2019). All companies and executives know how crucial it is to evolve with technology and create digital processes and solutions but developing and managing strategy is a different story (Blake, 2019). When it comes to the digital transformation of industrial automation companies, they are unique. Strategic leadership is responsible for developing an

organization's internal transformation strategy and externally enabling processes and manufacturing industries to transform digitally.

1.2 Research Aim and Objectives

This study explores how IA companies should manage the internal and external digital transformation to gain a competitive advantage. The specific objectives are:

1. To explore the requirement of digital transformation for IA companies: driving factors.
2. Analyze the success and failure of digital transformation in other business areas and lessons learned.
3. Identify the areas that are required to transform.
4. Assess the current digital maturity level of IA companies.
5. To investigate the key digital technologies that IA companies adopted for digital transformation.
6. Identify the success factors.
7. Develop the framework/strategy.

1.3 Research Questions

A set of research questions were developed by reviewing the existing literature to guide the research. Hence, the research study sought to collect data to answer and Examine the following research questions:

1. Why IA companies required to implement digital transformation?
2. Why did digital transformation fail in most organizations and succeed in some companies? Furthermore, what IA company leadership can learn from it?
3. What are the action fields in IA organizations that require transformation?
4. What is the current digital maturity level of IA companies?
5. What critical digital technologies have IA companies adopted for digital transformation?
6. What are the success factors of digital transformation for IA companies?

7. How to implement digital transformation in IA companies?

1.4 Hypotheses

Based on research objectives and a review of the literature, the following hypothesis is formulated to understand the relationship between critical success factors (CSFs) and the success of digital transformation for IA companies.

Null Hypothesis:

H_0: Critical success factors have no relationship with IA companies' digital transformation.

Alternative Hypothesis:

H_1: Critical success factors have a significant relationship with the digital transformation of IA companies.

1.5 Significance of the Study

Digital transformation has seen unprecedented growth across the business world in the last three to four years. The impact of Covid-19 further highlighted the importance of transformation and the need for speedy implementation. Manufacturing and process companies are experiencing accelerated growth, driven by market and technology conditions. At the same time, companies are under compulsion due to fluctuating commodity prices, decreased capital expenditures, more stringent environmental regulations, an aging workforce, and increased competition. Process and manufacturing companies are looking at IA companies to enable them for much-needed transformation. IT companies like Accenture, IBM, TCS, and Wipro are also entering this business and competing with traditional IA companies. Hence IA companies must transform at two ends, one for internal operational efficiency and the second for supporting the customer i.e., manufacturing and process industries.

Transformation is not something that we can buy and plug in. It requires a well-formulated strategy, implementation, and sustaining continuously to remain competent in the market.

This thesis empirically studies the practices followed for successful digital transformation. The researcher has studied the lesson learned from failed transformation initiatives and identified the success factors through a literature review and interviews with industry practitioners. A digital transformation strategic management is developed to support the IA company transformation journey. Research and its findings are significant to IA organizations and other business areas. Research findings can be applied to other domains like automotive, insurance, manufacturing, process industries, and businesses. Companies that apply this strategic framework and consider these factors are expected to flourish and expand their growth.

1.6 Benefits of the Study

This study shall benefit the following companies and stakeholders.

1. Industrial Automation Companies: Thesis will help industrial automation companies identify the digital transformation drivers and current trends in the process and manufacturing industries and business world. It helps IA companies formulate a strategic management plan for their organization-specific digital transformation. IA companies in the transformation journey can apply the success factors recommended in the thesis.
2. Leaders and Employees: Leaders and employees can utilize to understand the need, success, and failure lessons, digital readiness, skill gaps, a strategic management approach in digital transformation, and how this can be implemented in IA companies and customers of IA companies.
3. Process and manufacturing industries and other businesses: Success factors and strategic management processes are intended to help process and manufacturing companies like oil and gas, refineries, power, chemical, automotive, etc.

1.7 Ethical Statement

The researcher has complete knowledge of the ethical issues related to the research (Bell and Waters, 2018). The researcher has strictly followed research process rules and regulations.

After their approval to participate in the survey, research questions were distributed to professionals. The cover letter was supplied along with questionnaires to all participants; this helped them understand the student research, respondents' expectations, and the confidentiality of their responses.

The researcher will ensure that no professionals participating in the survey will face any harm during or after this project. Furthermore, the researcher will ensure the research work's integrity and the collected data's correctness. These ethical considerations must be followed at a colossal scale as it helps in giving absolute validity to the report. The quality of the report and ethical considerations have great connections with each another. The researcher is responsible for conducting the research in line with the defined objective and purpose.

Research work complies with all terms, conditions, and defined research processes. Hence researcher is confident that there is no lapse in flowing ethical requirements of the research and that the work is as per the ethical guideline.

1.8 Structure of the Thesis

This research work is organized logically, enabling the readers and academics to understand how research questions are addressed and the research objectives are achieved. The thesis starts with a brief introduction in chapter-1 and ends with a conclusion and recommendation in chapter-6.

Chapter 1: The first chapter introduces the research work; it explains the research background, problem statement, research questions, objectives, hypothesis, and

significance of the study. A brief overview of the other chapters is covered in the first chapter.

Chapter 2: In chapter two, the researcher covers the definitions of digitization, digitalization, and digital transformation. The chapter critically analyzes emerging technologies, Industry 4.0, and the impact of Covid-19 on digital transformation. The current position of IA companies and cyber security challenges are empirically studied. Failure lessons and success stories from different industry domains are critically evaluated.

Chapter 3: This chapter discusses strategic management, digital leaders, traditional and agile project management. Further, this chapter holistically studies and analyze the scholars, industry portioners, and different consulting firm view on digital transformation driving factors, focus areas, digital maturity, and different frameworks on digital transformation.

Chapter 4: This chapter discusses the research design and methodology used for qualitative and quantitative analysis and empirically investigates the research objectives, hypothesis, and questions. The chapter discusses why qualitative methodology is selected to answer most questions. In addition, the chapter also covers the reason for selecting mixed (qualitative and quantitative) for success factors analysis. Furthermore, the sample size chosen for the study has been explained. The research plan and process are covered in this chapter.

Chapter 5: Chapter 5 is about analyzing the gathered data and its interpretation. Both Qualitative and Quantitative analysis is performed. Hypothesis tests is included in this chapter. This chapter proposes the SPOT framework for success factors of digital transformation.

Chapter 6: The sixth chapter includes the summary of the findings, suggestions by the researcher, digital transformation strategic management framework, research limitation, and scope for further research work.

Chapter 7: References

Table 1 provides chapter details where the research objectives and questions are addressed.

Sl No	Research Objectives		Research Questions	Chapter Addressed
RO1	To explore the requirement of digital transformation for IA companies: Driving factors.	RQ1	Why IA companies required to implement digital transformation?	Chapters 3 and 5
RO2	Analyze the success and failure of digital transformation in other business areas and lessons learned.	RQ2	Why did digital transformation fail in most organizations and succeed in some companies? Furthermore, what IA company leadership can learn from it?	Chapter 2
RO3	Identify the areas that require to undergo transformation	RQ3	What are the action fields in IA organizations that require transformation?	Chapters 3 and 5
RO4	Assess the current digital Maturity level of IA companies	RQ4	What is the current digital maturity level of IA companies?	Chapters 3 and 5
RO5	To investigate the key digital technologies that IA companies have adopted for digital transformation	RQ5	What critical digital technologies have IA companies adopted for digital transformation?	Chapters 2 and 5

RO6	Identify the success factors	RQ6	What are the success factors of digital transformation for IA companies?	Chapters 2 and 5
RO7	Develop the Dx Framework/Strategy management	RQ7	How to implement digital transformation in IA companies?	Chapter 6

Table 1: Traceability matrix of research objectives, research questions, and chapter addressed (Own development)

2 CHAPTER 2: A REVIEW OF LITERATURE ON DIGITAL TRANSFORMATION

This chapter presents a literature review of the digital transformation concept. The chapter analyzes various definitions and scopes of digital transformation from the perspectives of scholars, academicians, industry domain professionals, and consulting companies. There are benefits and challenges to implementing digital transformation, and the researcher has performed an in-depth study of digital transformation from various perspectives.

2.1 Introduction

In today's competitive business market, digital transformation is crucial for continuous business growth (Javadi, 2022). The digital transformation had the allure of turning data into insights. The transformation will help organizations understand customer behavior and then use data to develop a solution for a better customer experience (Kissel, 2021). Digital transformation has seen tremendous growth in the last four to five years and will increase further; the Covid-19 pandemic catalyzed the growth of digitization. Global DX spending is forecast to reach $3.4 trillion in 2026 with a five-year compound annual growth rate (CAGR) of 16.3%, according to the international platform specialist company Statista.

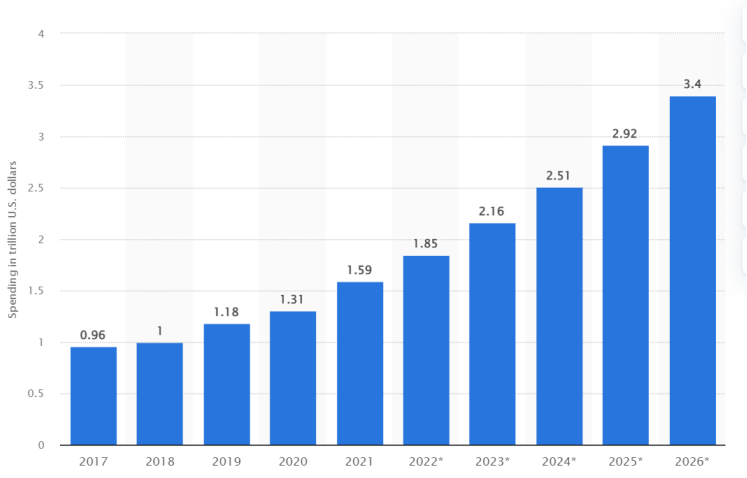

Figure 2: Spending on digital transformation technologies and services worldwide from 2017 to 2026 (Statista, 2022)

In Mckinsey's quarterly reports, Sibel (2017) discusses the benefits of digital transformation. According to Sibel (2017), value chains like defense, education, financial services, government services, healthcare, manufacturing, oil and gas, retail, telecommunications, etc., will be disrupted. However, to get the benefits of digital transformation, speed of deployment is essential. As Eric Pearson, CIO of InterContinental Hotel Group, said, "It is no longer the big beating the small, but the fast beating the slow" (Yokogawa, 2021). Hence, digital transformation is the top priority on the agenda of CEO's. All the tremendously innovative digital firms that utilize technology and resource to transform their organization are radically disrupting others in the market. The story of the Blackberry mobile company and the Apple smartphone is a well-known example that demonstrates what happens if digital disruption is taken lightly. Blackberry lost its market capitalization dramatically, and today, Apple is valued at 2.35T$.

2.2 Change or Transform

Change is often confused with transformation; changing the business or any process is complex, and changes are challenging. However, change and transformation are different; change is like a snake shedding its skin, whereas transformation is like a caterpillar becoming a butterfly (Safruddin et al., 2014). Westerman (2018) agrees with Safruddin and says that the change should be made in the right way, or else the caterpillar could turn into a fast caterpillar (Ali, 2019).

Change can be simple and incremental, or sometimes it can be large and complex. Change is implemented because of external factor's influence and is a short-term response. It does not necessarily involve tweaking the organization's vision, objectives, or goals. Examples of changes include:

1. Moving premise-based software development to cloud-based development

2. Migrating to ERP software

Both the above changes are important and solve specific problems. Transformation is a more significant effort and does not necessarily require any external influence. Transformation is a fundamental internal evolution of the organization to meet specific goals and objectives. Transformation examples include:

1. Shifting the organization from a product-based company to a customer-centric organization.

2. Big Data driven marketing automation

Digital transformation involves people, processes, and emerging technologies; it addresses customer pain points and helps organizations handle disruption and reposition themselves in the market.

2.3 Digital Transformation Definition

Academic scholars have not agreed on a standard definition of "Digital Transformation" (Schallmo and Williams, 2017). The meaning of digital transformation is different for different people, but its concept is a success mantra for most leaders. While Matt et al. (2015), defined transformation as the fundamental change in organizational work. Henriette et al. (2016), described it as a disruptive or incremental change in the process. According to Westerman, Bonnet, and McAfee (2014), digital transformation marks radical thinking about how organizations use their people, process, and technology resources in a fundamental business operation change. Digital transformation uses new technologies like social media and business analytics to improve business operations and customer experience and explores new business opportunities (Fitzgerald et al., 2014).

Some organization thinks digitizing some services is digital transformation. Scholars disagree with this concept; they call such initiatives "digital upgrades" used to increase the efficiency of a particular operation or function. Digital transformation is an organizational

change; in less successful companies, digital transformation may be merely a marketing or operation function, and such digital stagey will not align with organizational strategies and is bound to fail (Libert, Bek, and Wind, 2016). Echoing similar views, Ramnarayana and Mehta (2020) explain digital transformation as the journey of strategically planned organizational change. To succeed, leaders must create a data-driven strategy, develop a culture of innovation, and empower the team with technology and methods. As the renowned McKinsey consultancy explains, transformation is less about one process and more about how companies perform their business (Dörner and Edelman, 2015). Both academics and professionals agree that digital transformation is not just a project which starts and has a definite end, not minor changes of going digital (like going paperless); digital transformation is the strategy through which organizations change the way manufacturing and doing business. Figure 3 lists some definitions of digital transformation.

Author(s)	Definition
G. Westerman, A. McAfee *et al.* [2011]	"(…) the use of technology to radically improve the performance or reach of enterprises is becoming a hot topic for companies across the globe. Executives in all industries are using digital advances such as analytics, mobility, social media, and smart embedded devices and improving their use of traditional technologies such as ERP to change customer relationships, internal processes and value propositions (…)"
M. Fitzgerald *et al.* [2013]	"(…) use of new digital technologies, such as social media, mobile, analytics or embedded devices, in order to enable major business improvements like enhancing customer experience, streamlining operations or creating new business models (…)"
M. McDonald, A. Roswell-Jones [2012]	"(…) as such, the Digital Transformation goes beyond merely digitizing resources and results in value and revenues being created from digital assets (…)"
E. Stolterman, A. Fors [2004]	"(…) digital transformation is the changes that digital technology causes or influences in all aspects of human life (…)"
BMWi [2015]	"(…) stands for the complete networking of all sectors of the economy and society, as well as the ability to collect relevant information, and to analyze and translate that information into actions. The changes bring advantages and opportunities, but they create completely new challenges (…)"
A. Martin [2008]	"(…) now commonly interpreted as such usage of Information and Communication Technology, when not trivial automation is performed, but fundamentally new capabilities are created in business, public government, and in people's and society life (…)"
D. Mazzone [2014]	"(…) is the deliberate and ongoing digital evolution of a company, business model, idea process, or methodology, both strategically and tactically (...)"
D. Bowersox *et al.* [2005]	"(…) process of reinventing a business to digitize operations and formulate extended supply chain relationships. The DBT leadership challenge is about reenergizing businesses that may already be successful to capture the full potential of information technology across the total supply chain (…)".

Figure 3: Scholars' Definitions of Digital Transformation (Kamila, 2019)

Pertaining to industrial automation, digital transformation is all about applying digital technology to make the system of organizational work self-reliant, optimize the process, and empower people and business leaders to improve performance (Yokogawa, 2021).

Benefits of digital transformation:

Digital transformation affects industry operation, productivity, stakeholder engagement, customer experience, and organizations; in fact, it influences the entire value chain of business. Digital transformation benefits industries, businesses, and the social world (Ali, 2019; Schindlwick, 2021). Some of the benefits are as below:

- Address customer pain points and increases satisfaction
- Improves operational efficiency
- It will increase the creation of new products and services
- Reduces human errors
- Ensure the high-quality user experience
- Increases Agility in the process
- Drives the data-based insights
- Increases customer reach value proposition
- Increases return on investment (ROI)

2.4 Digitization, Digitalization, and Digital Transformation

Regarding process industries, manufacturing, and IA companies, digital transformation can be categorized into three phases, digitization, digitalization, and digital transformation (Yokogawa, 2021). These three terms have different meanings but are often used interchangeably (Bumann and Peter, 2019). In reality, these terms have different meanings;

people often get confused about them, resulting in underestimating digital transformation terms, and risking the survival of their organization. The three concepts are presented in figure 4.

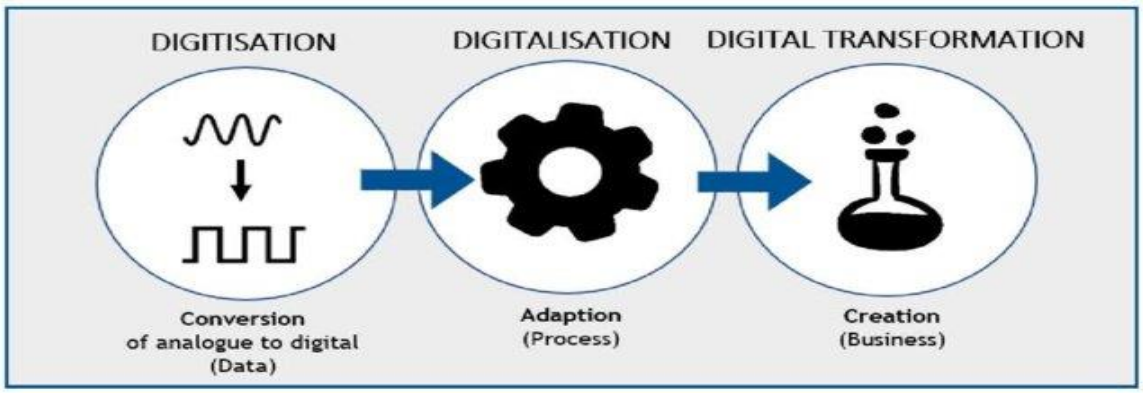

Figure 4: Digitization, Digitalization, and Digital Transformation (Maltaverne, 2017; Bumann and Peter, 2019)

The definition of digital transformation is slightly different for the industrial automation field. Few studies have been conducted on digital transformation definition. Yokogawa (2021) has summarized the definitions of these three terms in an e-book, as shown in Figure 5.

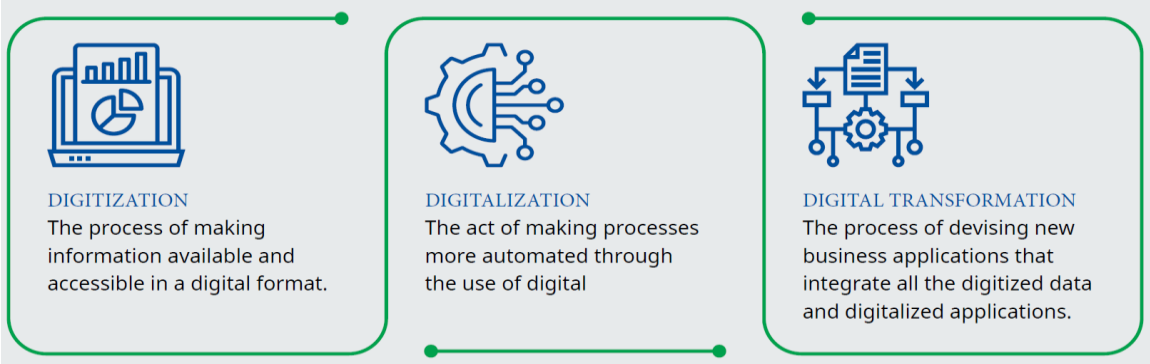

Figure 5: Digitization, Digitalization, and Digital Transformation for IA (Yokogawa, 2021)

Maltaverne (2017) discusses the evolution of digital transformation. As per Maltaverne (2017), digitalization is converting analog information to digital data. Digitalization is adopting new processes using digital technology, and digital transformation is about creating a new business or value proposition for customers (Maltaverne, 2017). Yokogawa (2021) defines digital transformation as integrating digitized data and digitalized applications. It is to be noted that digital transformation uses technology in combination with data, people, processes, and assets, and technology itself is not considered digital transformation.

According to the researcher, IA company perspective, digital transformation can be defined as below:

Digital transformation (DX)= Enabling Capability of Industry 4.0 for clients+ Business Process transformation+ Organization transformation.

2.5 Emergence of Disruptive Digital Technologies

Digital savvy companies like Netflix, Airbnb, Amazon etc. disrupted their respective industry sectors using resource, technology, and data-driven approaches. Through these digital technologies, customers have the flexibility and facility which they may not have even imagined. Even though digital transformation is a new concept, its evolution started with the integration of computer software and hardware in the 1950's (Gibe and Kalling, 2019; Ali 2019). Figure 6 illustrates the digital technology evolution timeline. The first commercial computer was introduced in 1951and the first main frame was in 1961. Since the beginning of the computer era, academics and practitioners have shown interest in information technology (IT), digital technology, and its impact studies (Real, Leal and Roldan, 2006; Sambamurthy, Bharadwaj and Grover, 2003; Ali, 2019). The 1980's brought computer production to films, robots to industry, and automated teller machines (ATMs) to banks. The year 1971 saw the first email, and in 1981 laptop was introduced, whereas in 1984, the first mobile phone was launched. Advanced stages of the digital transformation began with the world wide web (WWW) in 1989 and mobile internet in 1998 (Gibe and

Kalling, 2019; Westerman, Bonnet and McAfee, 2014; Ali 2019). In the mid-2000, platform-based companies like Facebook (2004), Airbnb (2008), and Uber (2009) were born with strong disruption potential of traditional business models (Gibe and Kalling, 2019). The main digital transformation (DX) era started in 2010 when the digitalization of existing analog and manual systems was nearly complete (Schallmo, Williams, 2018).

Now we are living in the age of digital transformation and digitized age. All forms of business and social life have transformed from reading newspapers to buying groceries, healthcare, banking, transport, and logistics to education. Digital transformation is not showing any sign of slowing down, and it is going to be here. Throughout the digital evolution timeline, organizations that does not adopt the transformation have perished or reduced to smaller players and been defeated by digital giants (Harvard business review, 2017). Disruption, however, has not finish it is ongoing process which cannot be stopped, only adopted (Schindlwick, 2021).

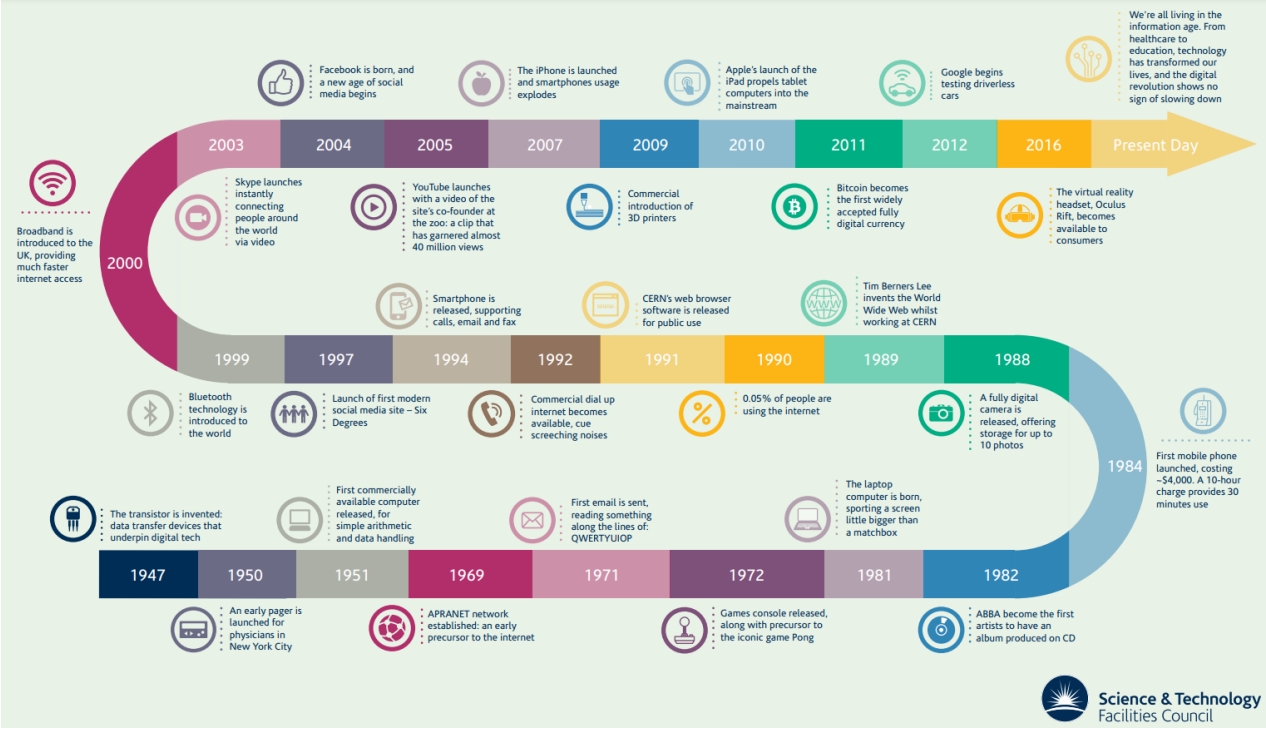

Figure 6: Evolution of Digital Technology (Science Technology, 2019)

The impact of the digital disruption is further demonstrated in below figure 07. The figure shows how organizations like YouTube, Facebook, Twitter, and Pokémon reached customers using present-day digital technologies. For instance, Pokémon took only 19 days to reach 50 million users, whereas Airlines took 68 years. These examples show the importance of digital technologies and the dependency of organizations on transformation to reach the customer base.

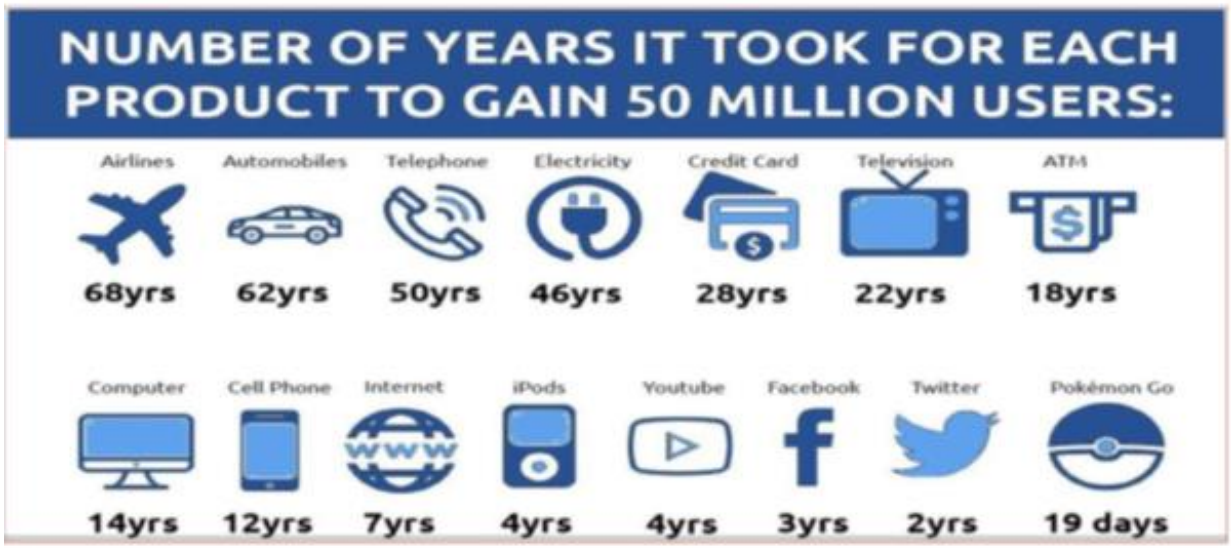

Figure 7: Evolution of Digital Technology (Ali, 2019)

At the micro level, the contemporaneous implementation of the internet of things (IoT), machine learning (ML), artificial intelligence (AI), Big data analytics, and digital platforms contest traditional organizational competencies and skills (Baralou and Tsoukas, 2015; Dougherty and Dunne, 2012; Yeo and Marquardt, 2015). An important part of digital disruption is the development of emerging industry technologies. Using the new digital technologies and innovations, new entrants, regardless of their size, have been able to disrupt and reshape traditional industry boundaries (Lyytinen and Rose, 2003; Nunes and Downes, 2013; Schwab, 2017). For instance, Airbnb the world's largest hotel and accommodation provider, does not own any hotels or real estate, the same way Uber or Ola, the taxi service provider, does not own any vehicles. Similarly, innovative digital

companies like Apple, Amazon, Google, or Twitter established entire business models around digital and disruptive innovations (Keen and Williams, 2013; Weill and Woerner, 2015). Uber disrupted the taxi industry, Airbnb the hospitality business, Apple showed the door to Blackberry, and Amazon was able to disrupt the entire grocery to house hold item business. All these companies embraced and adopted digital technologies to be successful in the market. It is imperative for organizations to transform from traditional business models to digital ones.

Traditionally IA companies have supplied the plant control system to automate the operation technology (OT). Now, these companies are witnessing the transformation of legacy control system components, control design, and engineering processes through emerging digital technologies like virtualization, digital twins, edge computing, and open automation forum (OPAF). As a result of Covid-19, the transformation trend has accelerated. In addition, many technological trends are emerging, driving, and enabling digitalization (Tang, 2021). Important trends include industry 4.0 (Piccarozzi et al., 2018), internet of things (IoT), cybersecurity, big data & analytics, cloud computing, robotic process automation (RPA), artificial intelligence (AI), machine learning (ML), blockchain, and others (Schaede, 2020; Brien, Resnick, and Avery, 2018; Ramnarayan and Mehta, 2020). The applicability of technology is mainly dependent on the industry and organization. Each trend is a chapter and a matter of unique research for scholars. Digital transformation in IA companies uses IIoT, big data & analytics, AI, digital twins, cloud computing, and ML, to enable the digital transformation of client requirements in oil and gas, chemicals, pharmaceuticals, etc. IA companies mainly use RPA for optimizing the repetitive process. As Kane et al. (2016), pointed out, in addition to process and technology, creating new mindsets and changing company culture is critical for successful transformation. This research study reveals that most industry automation (IA) organizations are rushing to become the enablers of their customer's digital transformation but still lagging in internal operation and business transformation.

2.6 Industry 4.0 and Digital Transformation

Industry 4.0 and digital transformation are often used as interchangeable concepts, with the belief that both are the same. Industry 4.0 undoubtedly brings digitization to the manufacturing sector using digital technologies, but digital transformation is much more than just digitizing manufacturing companies. Numerous industries are implementing industry 4.0 and digital technology to improve, automate, and modernize the entire procedure. It includes cyber-physical systems, the internet of things, and cloud computing (Neugebauer et al., 2016). Digital transformation is directly linked to the internet of things (IoTs), industry 4.0, and digital ecosystems. Based on this industry 4.0 meaning, some academics argue that the fourth industrial revolution is digital transformation itself. However, unlike industry 4.0, digital transformation is not limited to manufacturing industry; it covers broad finance, medicine, education, and media domains.

In his explanation, Walker Reynolds, president of 4.0 solutions, differentiates Industry 4.0 and digital transformation. As per Reynolds, industry 4.0 is a movement, and currently, companies are facing this revolution. In the third revolution (Industry 3.0), the focus was on automation and automation-generated data; in Industry 4.0, the focus was on generating information from the data. Reynolds calls digital transformation the mechanism or strategy to achieve industry 4.0 (Reynolds, 2020).

Industry automation companies' (IA) core business is with manufacturing and process industries, and IA companies are expected to enable and support these industries in achieving Industry 4.0 and digital transformation success. Hence, understanding Industry 4.0 is an essential part of digital transformation strategy management.

Figure 8: Industry 4.0 Technologies (Mittal et al., 2019; Bali et al., 2020; Meloeny, 2022)

Vital technologies used in industry 4.0 are illustrated in figure 8 above. The industrial internet of things (IIoT) is the critical component; equipment at plants and factory floors is installed with sensors, which enables machines to connect with web-enabled devices. IIoT helps to gather a large amount of data, which will be used for further analysis (Ahmed et al., 2022). Cloud computing is a computing technique in which information technology services are provided by low-cost computing units connected by IP networks (Qian et al., 2009). Mobile technology covers smartphones, tablets, wearable devices, etc., and portable devices used for connectivity and to achieve required functionality (Ali, 2019). 3D printing is a process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of material. 3D printing processes require software, hardware, and materials to work together (Shahrubudin, 2019). Big data is generated from several sources, like the click of the internet, social media, mobile transactions, the internet of things (IoTs) or purchase transactions (George et al., 2014). Big data can be used to analyse structured, semi-structured, and unstructured data. Cybersecurity is the state or process of protecting and recovering networks, devices, and

programs from any cyberattack. Industries must consider a robust cybersecurity approach encompassing IT and OT to transform into Industry 4.0 (Ali, 2019). In RFID, or "radio frequency identification," technology, digital data encoded in RFID tags or smart labels is captured by a reader via radio waves. RFIDs are used in restricted access control, material tracking, asset management, and supply chain management (Iyer, 2005). Cognitive computing is a platform influenced by cognitive science; it instantly processes enormous amounts of data to answer specific queries and makes customized intelligent recommendations (Behera, 2019).

The main objective of Industry 4.0 is to make the manufacturing process faster and more efficient, increase the quality of products, and be customer-centric by using automation and digital technologies to identify new business opportunities (Meloeny, 2022). In industry 3.0, companies automated the processes using logical processors like PLCs (programable logic controllers) and SCADA (supervisory control and data acquisition). The industry 3.0 revolution started in the early years of 1970. Industry automation (IA) companies dominated industry 3.0 with several automation products that helped the manufacturing plants optimize operations. However, industry 4.0 is a journey towards automated plants to autonomous plants, where operation technology (OT) and information technology (IT) converge to increase operation flexibility, agility, and productivity (Yokogawa, 2021). Unlike industry 3.0, where IA companies were competing in the domain of operation technology automation, in the industry 4.0 era, IA companies are facing tough competition from IT companies, system integrators, and digital transformation consultants, eager to dominate process and manufacturing operation technologies.

2.7 Impact of Covid-19 on Digital Transformation

The current situation created by the Covid-19 pandemic had a destructive effect on the economy of the entire world, but it is acting as a catalyst for digital transformation. Every company globally started thinking about digital transformation and the various ways to engage its customers through digital communication (Twilio, 2020).

Twilio (2020) surveyed the first wave of pandemics in June 2020. Questionnaires were administered to 2500+ employees around the globe, including CEOs, directors, strategists, and leaders. As figure 9 illustrates, 93% of corporate leaders agreed that the pandemic pushed their organizations towards digital transformation, and as per figure 10, 43% of leaders wanted to transform their organizations in the next 1-4 years.

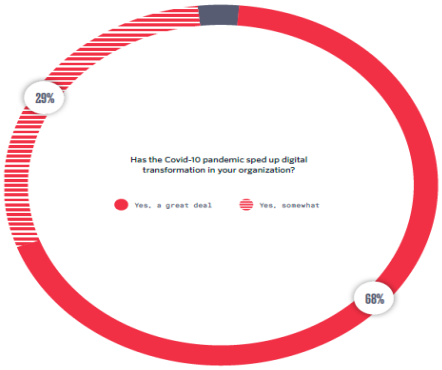

Figure 9: Acceleration of Digital Transformation (Twilio, 2020)

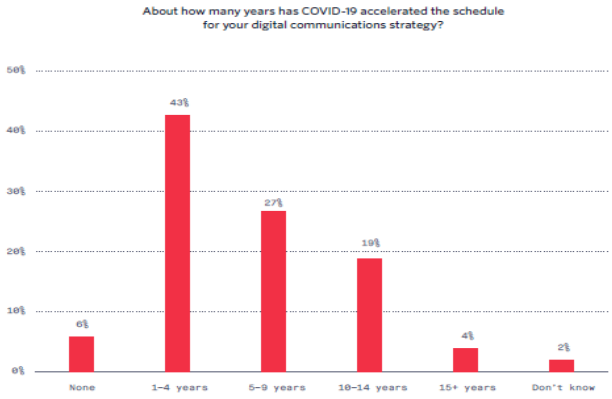

Figure 10: Acceleration in Leadership Effort (Twilio, 2020)

As shown in figure 10, Covid-19 forced leaders to think about remote engineering, the usage of digital technologies, the safety of resources, and limitations (Jeff, 2020). As a result of this pandemic, transformation planning of 8-10 years was compressed to a few weeks and months, and companies started investing heavily in digital infrastructure (Twilio, 2020).

Mckinsey and company survey in figure 11 shows similar results; despite other domains experiencing tightened investment, investment in digital and technology was increased. It observed that the pandemic had sped up the adoption of digital technologies by several years (Mckinsey, 2021). Executives they surveyed agreed that much more quickly than they thought possible before the Covid-19 crisis (Laberg et al., 2020).

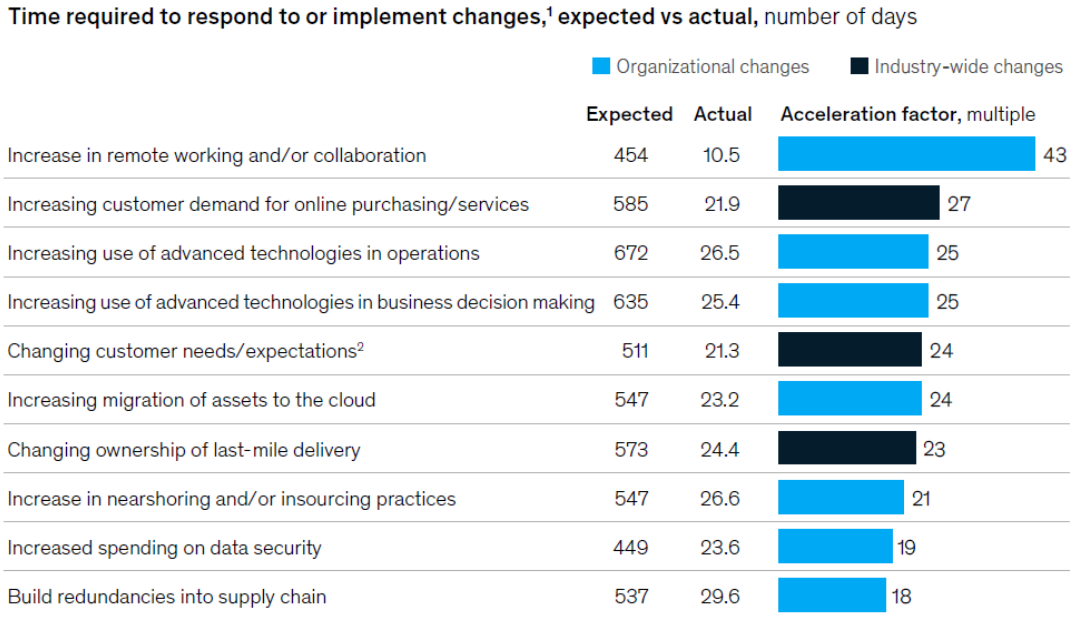

Figure 11: Mckinsey survey on Covid-19 impact on digital transformation initiatives (Laberg et al., 2020).

Mckinsey and Twilio's survey and findings indicate that if Covid-19 had not occurred, the industry leaders might have acted slower, and the digital transformation process would have taken at least a decade.

2.8 Failure lessons and Success factors

"Studies indicate that a staggering 70% of digital transformation failed, as there is a huge difference between planning and putting the plan into action. Of the $1.3 trillion that was spent on the year 2019, it was estimated that $900 billion went to waste" (Mckinsey and HBR, 2020). Echoing similar views, BCG (2021) reports that just 33% of organizations meet the challenges of disruption. BCG further identifies a substantial gap between companies' digital aspirations and actual implementation (BCG, 2021).

Digital transformation is still a "work in progress" effort for IA companies; as of date, none of the companies have entirely transformed both externally and internally. Hence to answer the second research question: "Why did digital transformation fail in most organizations and succeed in some companies? And what IA company leadership can learn from it?" literature review from the fast project execution is the most appropriate data to gather lessons learned repository.

Libert et al. (2016) and Saldana (2019) discussed the failure of digital transformation. Scholars raise the concern that many companies have endeavored on digital transformations only to hit roadblocks, and the failure of digital transformation ranges from 66% to 88%. Libert et al. (2016) notice that such failure is not surprising as organizations are trying to develop completely new competencies. Another observation was the skill level of the transformation leaders. Most of them were trained and experienced in change management, whereas digital transformation a much deeper organization-wide update. Yokogawa (2021) grouped the causes of the failure into three main categories: people and organization barriers, process barriers, and technology barriers. Lack of leadership, skill gaps, lack of road map and governance, and cyber security risks were the main issues to be addressed.

Studies from Davenport and Westerman (2018) and Blake (2019) also reported a 70% failure of the transformation initiative. The researchers did a holistic study of the transformation failure initiative by GE, P&G, and Ford. Despite pouring millions of dollars, the project, it did not take off as expected, with company stocks dropping and forcing leaders to focus on short-term rather than long-term goals. The primary cause of the failure was a misalignment between strategic vision and objectives. Leaders of these organizations failed to integrate digital solutions into the prime business domain and could not judge the market competition. Table 2 summarizes the initiatives' results, consequences, and lessons for future leaders before starting digital transformation initiatives.

Organization Name	Initiatives	Results	Lessons
GE(General Electric)	In 2011 Digital Software and 2015 GE Digital was created with the goal of leveraging data to transform GE to technology giant.	Despite Pouring millions stock prices dropped and other products suffered. Project did not provide expected results. Leadership forced to focus on short term goals and instead of long-term innovative goals. CEO was forced to move out	• Do not invest without strategic focus. • Do not try to transform all at one go, incremental transformation recommended. • Engaging thousands of employees is not useful, transformation is done with skilled and passionate few employees and leaders.
Ford	In 2014 Ford smart mobility with the goal of digitally enabled car for enhanced mobility.	Since new segment was integrated with other segment of the Fords, quality issues arose, stock prices dropped, and CEO was asked to stepdown.	• For best results Digital transformation efforts are required to be integrated with rest of the areas of the company.
Procter and Gamble	In 2012 P&G started digitalization with the goal of becoming most digital company in the world.	P&G's broad goals were required broad initiative but lacked the purpose. Due to market slow down imitative faced the problem from the start, finally leading to departure of CEO.	• P&G failed to consider market condition. Always analyze the external factors before investing on transformation. • It was already ahead of competitor in the market, such massive investment was not required, it would have focused smaller digital efforts targeting its products and process. • Do not undertake digital initiative if it is not fit to strategy

Table 2: Failed digital transformation initiatives and lesson for feature implementation (Davenport and Westerman, 2018; Blake, 2019)

The same was the issue with E-commerce giant Walmart, which invested heavily only to drain the company resources. Many organizations fell prey to the temptation to quickly acquire and incorporate new technologies, viewing them as panaceas rather than essential for a long-term strategy (Saldana, 2019).

To summarize, below is the lesson learned from the above literature review:

1. Analyze internal and external factors before deciding on transformation

2. Investment in digital transformation should have strategic alignment

3. Avoid silo transformation; it should be integrated with all areas of the company.

4. Upgrade the skill set of employees and build the infrastructure

However, these failures should not derail the digital transformation efforts; these lessons are guiding steps for leaders while implementing in their organizations. Blake (2019) revealed in her publication that companies like GE and Ford did manage to adjust their strategy and succeed at a later stage.

There are some success stories with digital transformation. Companies like Google, Amazon, and Facebook transformed their business and became part of the digital ecosystem by leveraging core technology for shopping, marketing, and digitizing everything (Ahmed, Gurumurthy, and Khetan, 2018). Airbnb and Uber are good examples of demonstrating technology usage to disrupt the existing status quo system and become successful in taking over the market share. One common thing for both Airbnb and Uber is that both are born digital companies. Netflix's case study shows that the company can be successful by aligning the strategy with objectives, leveraging new technologies, and using an agile approach (Glaser and Shaw, 2022). In 1997 when Netflix was founded, its objective was to provide convenient home entertainment. During the initial phase, it

leveraged the internet to improve the customer experience compared to the competitors who offered video rental shops. As bandwidth technology was evolving and video streaming on the internet was becoming feasible, Netflix quickly adapted and positioned itself to meet its objective with new capabilities. Data analytics features supported Netflix in suggesting movies based on earlier rentals, further improving the customer experience. Amazon and other E-commerce use this technology to increase customer online shopping experience. In addition, Netflix is agile and innovative; as the technology evolved, it learned to capitalize it. When smartphones barged into the market, Netflix was quick to offer video viewing on smartphones. It also revolutionized the payment structure; instead of payment per DVD, customers can choose a subscription model. This made Netflix a favorite form of entertainment. Netflix's market cap increased from 1.87$ billion in 2007 to 314 $ Billion in 2021 Glaser and Shaw (2022). From Netflix's success story, industry leaders can learn that aligning strategy with objectives, leveraging new technologies, and being agile and customer-centric in innovation will increase competitive advantage in the market and transform the business. Instead of focusing on technology, Netflix worked to solve customer pain points while using technology as a tool to achieve its goals.

Ramnarayan and Mehta (2020) did a holistic study of the transformation of traditional organizations. The studied traditional companies were successful in implementing transformation strategies. They studied the transformation journey of L&T (An Indian multinational company and one of the world's top 30 contractors), Symphony Limited (world's largest manufacturer of air coolers), and Cavin Kare Private Limited (FMCG with 16 brands and present in over 16 counties). The researchers observed that these organizations paid attention to factors such as creating requisite capabilities (people); reshaping processes to link people to strategy (process and strategy); and using digital technologies like IoT, AI, and Cloud Computing to enable the transformation process. Schindlwick (2021) observed that a lack of management strategy and framework was the main reason for the failure. He recommended following a structured approach to tackle disruptive technologies. Refereeing to Professor Clayton Christensen, Schindlwick (2021)

recommends considering three factors: enabling technology, innovative business model, and coherent value network for successful implementation.

Strategy, People, process, and technology were the prime factors in implementing digital transformation. In addition to process and technology, creating new mindsets and changing company culture were critical for a successful transformation (Kane et al., 2016). It can be inferred from the studies of Ramnarayan and Mehta (2020), Blake (2019), and Davenport and Westerman (2018) literature review that strategic factors are pivotal for digital transformation. For the successful execution of digital transformation, Matt et al. (2015) emphasizes the importance of clear responsibilities and the need to get top management buy-in along with the process. As per Westerman et al. (2011), digital transformation initiative can be sustained if it is driven by a top-down approach.

Several academics, consulting companies, and practitioners have worked extensively to identify success factors that organizations must consider while implementing digital transformation. The researcher has summarized the success factor in table 3.

Authors/Consulting firms	Article/Publication Title	Key Success Factors(KSFs)/ Framework	Summary/List of Identified Success Factors
Westerman et al. 2011	Digital transformation framework – Westerman et al. 2011	Strategic assets	1. Strategy Management 2. Point of sale and distribution channels. 3. Products and content 4. Product innovation. 6. Partnership network brand, 7. Customer knowledge 8. culture
Matt et al. 2015	Digital transformation framework – Matt et al. 2015	Elements and success patterns	1. Assign adequate and clear responsibilities. 2. Sufficient transformational experience. 3. Top management support. 4. Transformational leadership skills. 5. Defined procedures and processes. 6. Continuous re-evaluation of DT strategies
Jacobi and Brenner, 2017	How large corporations survive digitalization.- Jacobi and Brenner, 2017.	Critical factors for digital transform.	1. Clear digital strategy with clear goals. 2. Involvement from top management 3. Collaboration with employees and leaders 4. Innovative, open and risk-taking culture. 5. Strong Partnership with vendors 6. Stake holder engagement
Bumann and Peter 2019	Action field of digital transformation	Digital transformation framework with sub dimensions	1. Digital strategy formulation and communication 2, Organization agility and cross functional collaboration 3. Strong leadership and committed management 4. Exploration of new technologies 5. Customer experience, insights and Analysis.
Gimpel et al. 2018	Structuring the digital transformation	Mastering six action field	1. Digital strategy and transformation management 2. Agile organization 3. Digital mindsets 4. Data integration, ownership and privacy of data. 5. Customer insights and experience management 6. Digital Manufacturing. 7. Digital eco system
Deloitte, 2015	Findings from 2105 digital business goal.	Strategy not technology drives the digital	1. Well developed business strategy 2. Define customer 3. Digital agenda is led from top 4. Conductive culture of the organization.
Mckinsey, 2018	Unlocking success in digital transformation	Drivers for success in digital transformation effort	1. Strategic alignment 2. Digitally savvy leaders, 3. Digital technology implementation capable workforce. 4. Usage of digital tools 5. communication and collaboration.
BCG, 2020	The critical success factors of digital transformation	BCG's six success factors	1. An integrated strategy with clear transformation goals. 2. Leadership commitment from CEO and other executives 3. Involving high caliber staff 4. Agile mindset governance 5. Progress monitoring 6. Business led modular technology and data platform
Digital Cxo, 2022	Digital transformation	The Critical success factors for digital transformation	1. Start with compelling business case 2. Formulate vision and strategy for transformation 3. All stake holders should have business first and customer centric mindset 4. Involve advisors and engage consultants
Yokogawa, 2021	Digital transformation in manufacturing	How to be successful in digital transformation.	1. Align with corporate goal and strategy 2. Break organization silos and collaborate 3. Identify the quick win and estimate benefits 4. Build technology foundation 5. Data drive approach 5. Leadership involvement

Table 3: Digital Transformation Success Factors

(Westerman et al., 2011; Matt et al., 2015; Jacobi and Bernnner, 2017; Bumann and Peter 2019; Gimpel et al., 2018; Deloitte, 2015; Mckinsey, 2018; BCG, 2020; FutureCFO, 2020; Digital Cxo, 2022; Yokogawa, 2021).

To summarize, scholars consider strategy, people, process, culture, agile, and technology as the factors required for successful digital transformation. However, more research is needed concerning the field of industrial automation. The present research focuses on IA companies and identifies the success factors. Transforming will be challenging, as IA companies need internal operation transformation and work as enablers for process and manufacturing industries' transformation. Moreover, IA companies are not digital startups; these companies are well-established market players from the era of industry 3.0 i.e., automation. Now IA companies must develop a strategy to compete in industry 4.0 and future industry 5.0. Through literature review and further qualitative and quantitative analysis, the researcher formed the success factors for IA companies that are expected to guide IA company leaders in their organizations' digital transformation.

This section meets the objective of learning lessons from previous failed digital transformations and success stories in other business areas. A literature review also answers the researcher's question, 'Why did digital transformation fail in most organizations and succeed in some companies? Furthermore, what IA company leadership can learn from it? The section provided the empirical repository of lessons learned and success factors from some practical implementation experiences.

2.9 Position of IA Companies, Opportunities, and Challenges

As the name suggests, industrial automation companies have been instrumental in digitalizing process companies, such as oil and gas, refineries, energy plants, chemical, and other manufacturing plants, for decades. There are many industrial automation companies and system integrators serving manufacturing companies. Table 4 shows significant automation companies with current market cap and domains of serving. Most of the companies are either from the USA or the European Union. Japan also has many well-

established automation firms. Several system integrators use the hardware from companies like ABB, Rockwell, and Honeywell and develop the software independently. These system integrators are pivotal in enhancing industry 4.0 solutions to process and manufacturing companies.

SL NO	Organization	Market Cap($)	Main Areas of the Service
1	ABB	58.18B	Provides solution from electrical , software, robotics, automation, and motion technologies.
2	Emerson	55.70B	Provides automation and digital transformation solution for industries, commercial and residential domains.
3	Fanuc	28.86B	Helping companies with smart factories and intelligent automation system. Its portfolio includes industry robots, CNC machines and injection molding machines.
4	Honeywell	142.28B	Through its automation wing "Honeywell Process solutions (HPS)" serves numerous process industries. It serves in engineering, technology licenses, cyber security and digital transformation of manufacturing companies.
5	Mitsubishi Electric	21.05B	Provides automation and processing technologies, power distribution and control products, industrial robots and computerized controllers.
6	Omron	10.51B	Industrial automation, electronic components, healthcare and solar power systems
7	Rockwell Automation	29.84B	Provides industrial automation and digital transformation solutions.
8	Schneider Electric	81.10B	Provides connected technologies and solutions to manage processes safely, reliably and efficiently. It also provide integrated management for homes, buildings, data centers and industries.
9	Siemens	112.89B	Provides technology for industrial automation, digital transformation, medical equipment, laboratory and IT solutions.
10	Yokogawa	4.9B	Provides industrial automation, test and measurement solutions. Company services include technology, engineering, project management and maintenance service. Company trying to provide end to end digital transformation to its customers

Table 4: Major Industrial Automation Companies

(Gray, 2022; IA companies market cap, 2022)

However, Industry 4.0 and new technologies like IoT, AI, Cloud, and Big Data have posed many challenges. Legacy systems like PLC (programmable logic controller), DCS (Distributed control system), and SCADA (supervisory control and data acquisition system) are challenged by open-source controllers and open-source automation (OPA) (Aghenta and Iqbal, 2019). While process industries are going through a tough time due to fluctuating commodity prices, factors such as strict environmental regulations, non-

availability of the workforce, and increased competition, are directly affecting the performance of IA companies (Yokogawa, 2021). IA companies must provide cost-effective control and automation solutions and act as enablers of digital transformation.

Traditionally, the competition was within a few significant automation companies like ABB, Emerson, Honeywell, GE Automation, Siemens, and Yokogawa. Presently, IA is no longer a traditional controller business. Big data, industry 4.0, cloud, and AI have raised the requirements and expectations of customers. By applying OT and IT system and using digital technologies, IA companies have realized that data and information is valuable assets that can be utilized to automate the process, capture more information on the process, analyze and share with customers and stakeholders, and thereby enhance their decision-making capability (Arcot, 2021). Due to the evolution of new technologies, many new entrants, such as Accenture, IBM, and Microsoft, are found in the IA field. As pioneers in process automation, IA companies have an excellent opportunity to acquire the digital transformation market of process industries. These companies can explore opportunities in life science, sustainable energy, and smart cities because they already possess commendable knowledge in sensors, monitoring, and control.

In order to meet new challenges, IA companies must require internal transformation, act as enablers of transformation in the process industry, and explore new business areas, such as life science and smart cities. Growth is possible if these companies develop a strategic and viable plan for implementing and managing digital transformation. How do you frame the strategic management plan, execute, and sustain it? It is challenging to Identify success factors that enable organizations in their digital transformation journey. This research aims to support and guide IA companies' digital transformation journey.

2.10 Cyber Security Challenges

Digital transformation involves the usage of the internet of things (IOTs), industrial internet of things (IIOTs), and cloud infrastructure, which are potential sources of cyberattacks. Data privacy remains the main concern for industries, businesses, and ordinary people.

Controls and regulation of personal information and business data are expanding and, if not appropriately managed, can undermine the company and public trust, reputation, and profits. Using automated tools for IT operations improves security and reduces human error. Automation tools help to identify the vulnerability faster and deploy the fixes, empowering businesses to be proactive and address vulnerabilities before breaches occur (Deshpande, 2022).

As more and more companies, including process industries, are going digital, there is an increased risk of data theft and security vulnerabilities (Yokogawa, 2021). IA companies did not face serious provocation in the legacy control system model, but the digital era has increased the hacking risks. Sectors like oil, gas, and energy are not just economic pillars but are politically influential. Cybersecurity risks are crucial, as both operation and information technologies have changed the appearance of cyber threats. Addressing the premises and realities of cybersecurity in Industry 4.0 is crucial (Clim, 2019). Building a robust cybersecurity system and establishing a management process is vital for successful digital transformation. However, security shall be seen not only as a challenge but also as evidence of the need to accelerate digital transformation initiatives.

2.11 Summary

This chapter presented a literature review of the discipline of digital transformation. It analyzed various definitions of digital transformation from academicians, industry practitioners, and consultants. It discussed the concept of digitization, digitalization, digital transformation, and the emergence of disruptive technologies. Industry 4.0 is closely linked with the digital transformation of industries; its different components are detailed in the literature review. Lessons from failed transformation initiatives and success factors help leaders plan to transform their businesses. The current position of IA companies, business domains, and challenges were discussed.

3 CHAPTER 3: A REVIEW OF LITERATURE ON STRATEGY AND DIGITAL TRANSFORMATION FRAMEWORK.

The main aim of this chapter is to understand the significance of strategy, strategy management, and frameworks in digital transformation and the contributions of academicians and consulting companies. Strategies are an integral part of all businesses and industries. Industrial automation and digital transformation business are increasingly growing, and IA companies aspire to capture the process and manufacturing business transformation. In addition, IA companies are eying on healthcare, life science, and space technology. This thesis helps to develop a strategic management plan for IA companies' digital transformation initiatives. Strategy definition and process are discussed. This chapter also discusses digital transformation frameworks with reference to the formulation and implementation processes.

3.1 Why Strategy and Strategic Management

Chapter 2 literature review details the significance of digital transformation to industries and the business world, but it is not software that we can plug in and use. Many organizations either failed or struggled in the digital transformation journey; however, this was not the endpoint, as many organizations like GE and Ford succeeded in the later stages. Research analysis pinpoints strategic management factors like misalignment between business strategy and goal, leadership, resource competency, culture, and businesses needing to be customer-centric (Davenport and Westerman, 2018).

In failure lessons, and success factors, academicians and scholars have stressed the importance of a strategic approach to digital transformation. Kane et al. (2015) research, in collaboration with Deloitte university press, reveals that "Strategy, not technology drives digital transformation." A further study from Ismail, Khater, and Zaki (2017) discloses competitive positioning of successful companies primarily depends on the strategies which their leaders deploy, and technology is a secondary factor. The results of the survey conducted by Verina and Titko (2019), and Mahmood and Khan (2019), show that most

professionals agree that strategy and strategic management are pivotal for the success of the digital transformation. Digital transformation is a strategic response to economics and disruptive technologies; hence it becomes strategic. To combat the challenges posed by digital disruption and stay competitive, organization leaders must formulate and implement strategies that may encompass the implications of digital transformation and create a better operational performance (Hess et al., 2016). Success requires an organization-wide changeover, a systematic approach to formulating a strategy, planning, and implementation is crucial for the success of the digital transformation.

3.2 Definition and evolution of Strategy and Strategic Management

Strategy and management are derived from the ancient Greek term 'strategos' (stratos or army, and ago or leading), Calusewitz (1780-1831) is considered the father of modern strategy (Lakshmana, 2012). Michel porter, a renowned professor from Harvard, defines strategy as “a broad formula for how a business is going to compete, what its goals should be, and what policies will be needed to carry out those goals” (Nickols, 2016). A more simplified definition is proposed by Nicklos (2016), who defined it as a general plan of action to achieve one’s goal and objective.

Chandler (2003) found that every firm in this competitive world needs to have a strategy and long-term planning. As per Gleck and Willis (1979), Strategic management is a stream of decisions and actions that lead organizations to plan effectively and meet objectives. Kazmi (2010) called strategic management a dynamic process to achieve organizational goals and objectives. The strategic process can be presented in four phases: formulation, implementation, evaluation, and strategy control (Kazmi, 2010; Rego et al., 2021).

The basic concept and phases of strategic management is presented in figure 12.

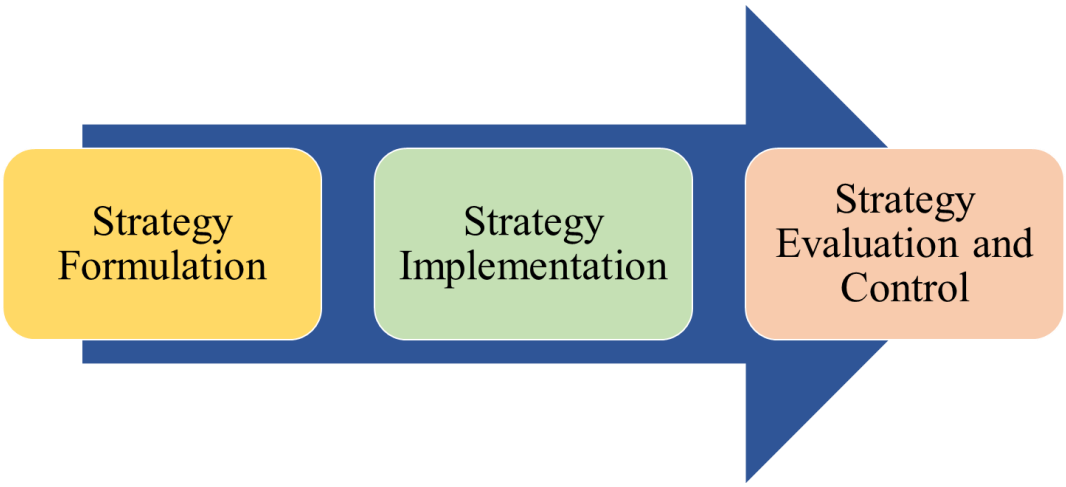

Figure 12: Basic Strategic Management phases

(Pearce, Robinson and Mital. 2012; Nicklos, 2016; Kazmi, 2010).

Strategy Formulation: It is considered an improvement over conventional long-range planning. Strategy formulation is mainly concerned with organization's internal and external environments (Pearce, Robinson, and Mital, 2012). The formulation consists of three phases, strategic direction, analysis, and action plan. In a strategic decision, top management sets the company vision and mission; in the analysis phase, organizational internal and external environmental factors are analyzed using tools like SWOT, and finally, utilizing the strategic direction and analysis phase results, an action plan will be developed (Nicklos, 2017, Pearce, Robinson and Mital, 2012).

Strategy Implementation: Strategy implementation is the execution of formulated plans developed in the strategy formulation phase. This phase implements planned strategies to achieve the organization's goals and objectives (Pearce, Robinson, and Mital, 2012). To implement strategy successfully, organizations require exceptional leadership and skilled employees. Complex activities are required to break down into simpler tasks.

Strategy evaluation and control: In this phase, strategists and leaders track the implementation process and results; it is a form of steering control. This phase will analyze the implementation, detect problems, and make necessary adjustments. The rapidly accelerating level of change in the global market has made the need for strategic control essential in managing companies (Pearce, Robinson, and Mital, 2012).

There is no agreement among scholars in deciding which phase of strategic management is more important: formulation, implementation, or evaluation and control. As per Baroto et al. (2014), strategy execution is less precise than formulating strategy. Jofre (2011) theory is in line with the concept of Baroro, which says implementing a strategy is more complex than formulating it. A well-formulated organizational strategy may fail to meet desired goals if it is unsuccessfully implemented (Yang et al., 2010). Rajasekar (2014) had a similar view; a strategy may fail or succeed depending on the implementation phase; hence, the implementation phase is most significant. As per Cater and Pucko (2010), the success of the strategy implementation depends on the information collected during the analysis stage of strategy formulation. Even though Bhardwaj et al. (2013) suggested a fusion of organization and information strategy, most of the scholars have strongly argued for a dedicated strategy for digital transformation (Davenport and Westerman, 2018; Hess et al., 2016; Roman, 2019; Albukhitan, 2020; Korachi and Bounabat, 2020; Peter, Kraft, and Lindeque, 2020).

All three phases of strategic management are equally critical for achieving the organization's goals and objectives. Implementation success depends on well-formulated strategies and governing control over the implementation. In addition, leaders are required to design the key performance indicator (KPI) or criteria to measure the success of the strategy implementation.

3.3 Digital Strategy and Importance of Leadership

Digital strategy is the starting point for implementing successful digital transformation (Ali, 2019). A digital strategy will provide a clear answer to "why transform," "what to

transform," and "how to transform" (Wade, 2015). Kane et al., (2015), further state that digital transformation does not stem from applying digital technologies; it depends on how organization leaders implement the digital strategy. Zaoui and Souissi (2021) findings align with Ali and Kane; both considered digital transformation a digital strategy steered into several business strategies through a digital road map. To improve the formulation of the digital strategy, leaders are recommended to use strategic intelligence to capture the external business environment and internal factors (Zaoui and Souissi, 2021; Van Tonder et al., 2020). Kiron et al. (2016), agree that digital transformation is not about applying technologies; it requires alignment of organizational factors. Nearly 90% of digitally maturing companies integrate digital strategy with overall organization strategy. Osmundsen, Iden, and Bygstad (2018) observe that organizations must align changes with their strategy to implement digital transformation successfully. If the digital strategy is not aligned with company goals and objectives, the transformation effort will be a wasted investment. The best digital strategies are objective-focused and address issues quickly and easily without draining the organization's resources (Agushi, 2019).

In the era of digital, disruptive technologies and expectations of digital customers are increasing daily; leaders should have the skill set to grasp the digitally savvy customer and their requirements and formulate the strategy.

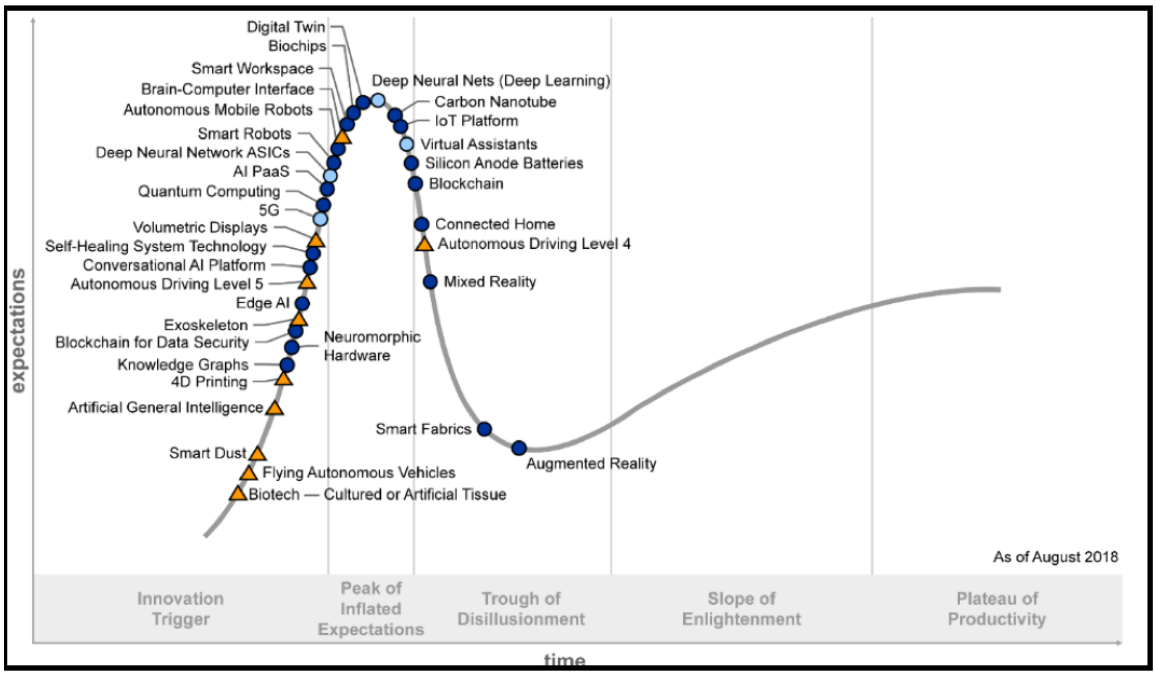

Figure 13: Gartner Hype cycle 2018

(Pearce, Robinson and Mital. 2012; Nicklos, 2016; Kazmi, 2010; Ali, 2019).

Ali (2019), in his research work, inducted "Gartner Hype Cycle2018" to show how technology is changing the business world. The cycle, as shown in figure 13, predicts emerging technology trends. For instance, deep learning, virtual assistance 5G trend may emerge in the next 2-5 years, blockchain for data security, connected homes, IOT platform in 5-10 years, and flying vehicles, artificial tissue, and autonomous robots may be a reality after 10 Years (Gartner, 2018; Ali, 2019). Gartner predicted these trends in 2018, many of which are already in use or in the advanced stage in 2022 e.g., Virtual assistance is already in use, and deep learning is in the advanced stage. The flying vehicle concept is in progress in cities like Dubai.

Academics have agreed on a leadership role in successfully executing digital transformation. Leaders of organizations must plan and formulate a strategy that aligns with the business goals and the desired objectives. The strategy makers of industrial automation companies must understand that technology is undoubtedly a powerful tool

when it is effectively combined with people, processes, and culture. Holistic studies by Davenport and Westerman (2018) and Blake (2019) of GE, Ford, and P&G reveal how leader's wrong focus and decision-making derail the objective and make the entire effort useless. At the same time, a comprehensive study by Ramnarayan and Mehta (2020) demonstrates how leaders guide the journey and ensure success. The clarity and vision of CEOs must align with organizational attainments. Attention must be given to creating requisite capabilities (people), reshaping processes to link people to strategy (process and strategy), and utilizing digital technologies like IoT, AI, and cloud to enable digital transformation.

Digital transformation is not an ordinary process that can be just assigned to some managers. Digital transformation requires the direct involvement of CEOs, and top executives, and leading the team through implementation, monitoring, and change management is imperative for organizational success. The digital transformation strategy requires leaders to identify their organizational goals and objectives and act accordingly. In the disruptive technology era, leaders are required to be smart enough to implement the right digital strategy and focus on customer-centric technologies. The best utilization of the technologies is possible only from the right skilled employees (Hendrick, 2017; Ali 2019). Regarding organization transformation, strategy, and leadership, John Welch, the then General Electric CEO, is a renowned name. John's tenure at GE combined strategic insights with managerial innovations. John aimed to create an organization with self-confident entrepreneurs to face reality and market competition. GE's transformation under John came in stages; John performed massive company expansion through many acquisitions, making GE an iconic American company firm. The transformation results were quite evident; GE's revenue increased five-fold, and the value of its shares on the stock market soared from $14 billion to more than $410 billion (Lohr, 2020; Watson, 2001). What John led was traditional business; currently, the world is experiencing digital era competition; digital leaders need to discover disruption occurring in products, operations, and marketing; and develop infrastructure to empower the team to exploit innovation for digital transformation (Ali, 2019). For instance, Steve Jobs of Apple, Elon Musk of Tesla, and Jeff Bezos of

Amazon are considered digital leaders. These leaders focused on innovation and developing digital firms instead of the status quo, disrupting their entire industry with new technology-enabled products or services (Ali, 2019). These leaders succeeded in transforming their organizations and businesses and took their firms to new heights.

3.4 Project Management in Digital Transformation Strategic Management

Digital transformation is not an isolated IT project; it combines numerous projects that transform every aspect of the organization into a digital-first. Digital transformation is not a project that has a definite start and end, but at the same time, strategic management involves resources, budget, schedule, and quality management. Successful execution of digital transformation requires efficient planning, implementation, and strict governance; hence, project management is a part of digital strategic management.

There are numerous documented project definitions, but most of them have common themes such as "Unique," "Temporary," and "Focused" (Harvey, 2010). The Project Management Institute (PMI) defines a project as a temporary effort to produce a unique product, service, or outcome for those seeking to formalize a project (PMBOK, 2017). In the management area, project management is one of the most researched topics by scholars (Beck, 1983; Katz, 1982; Nutt, 1983). Project management is the application of skills and knowledge, tools, and techniques by professionals and experts to meet the project's objectives. Project management is a science and an art and follows a systematic process to execute the project (Harvey, 2010). The twenty-first century has witnessed many project management standards emerging and different project management frameworks being developed. These frameworks are called "Boks" and are developed and promoted by reputed project management institutes like PMI (PMBOK), Projects in Controlled Environments (PRINCE 2) from "Central Computer and Telecommunications Agency (UK)", APMBOK developed by the "Association of Project Management Body of Knowledge", project management competencies developed by "International Project Management Association (IPMA)". From PWC 2014 survey PMI and Prince 2 are widely used frameworks.

There are two project management methods: traditional project management methodology (TPM), commonly termed waterfall method, and agile project management methodology. Some organization follows a hybrid, which is a combination of both TPM and agile methods. As shown in figure 14, TPM is a linear approach where each process follows the linear sequence and depends on predictable tools and experience.

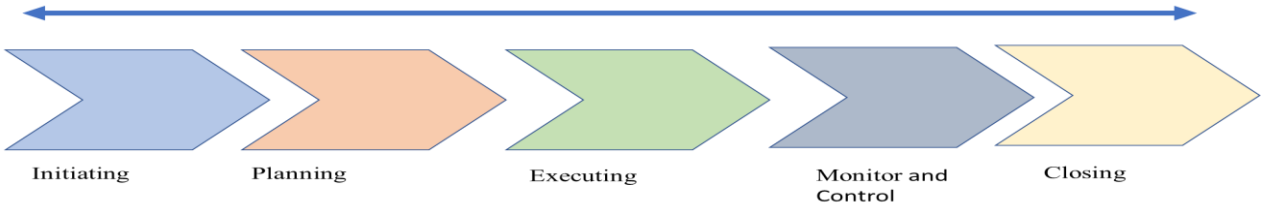

Figure 14: Traditional Project Management or Waterfall Methodology (PMBOK, 2017).

In TPM, the whole project should be conducted in a preset sequence (Chin, 2004; Hass, 2007; Salameh, 2014). Although this was seen as a solution, in the face of a dynamic project management environment (Cadle and Yeates, 2008; Salameh, 2014), it was viewed as a significant failure (Leybourne, 2009; Salameh, 2014).

Agility is described as the ability to be proactive in a dynamic, arbitrary, and changing environment. Organizational agility is an organization's capacity to adapt to changing environments without being pushed to change. APM consists of a mix of TPM principles with flexible, lightweight, collaborative, and adaptive procedures suitable for frequent changes (Leybourne, 2009). APM ideas and techniques were greatly impacted by the notions of agile methods of software development. Agile development techniques such as Scrum, Extreme Programming, and Lean are all driven by a set of principles.

As illustrated in figure 15, the APM method is built on quick delivery iterations and continuous learning (Sauer et al., 2009). At the start of the project, the project team performs streamlined planning, specification of requirements, and creating a solution for the project. The team then participates in waves of iterations, including more thorough

planning, needs analysis, design, performance, testing, and delivery to customers and stakeholders.

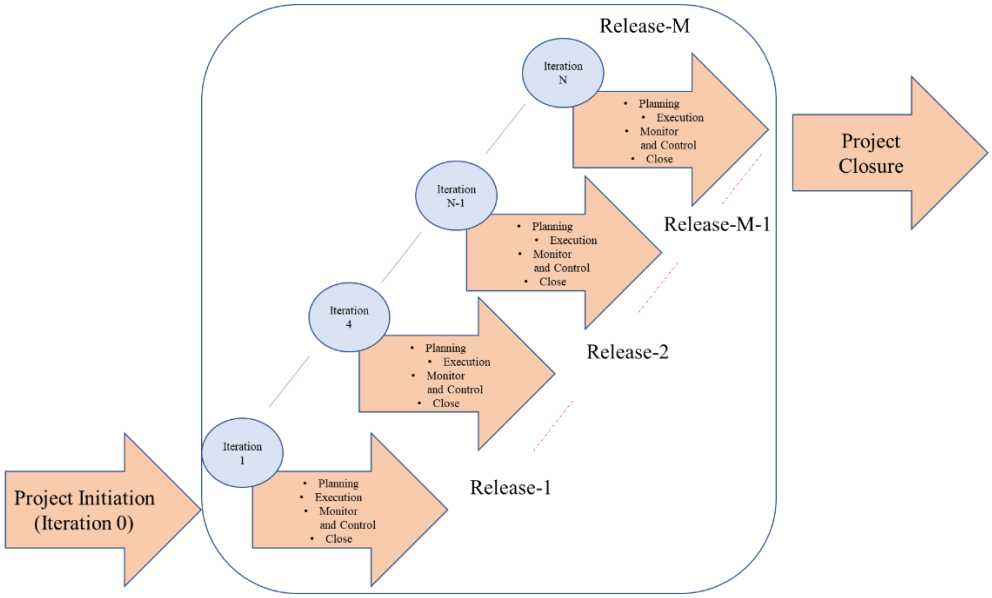

Figure 15: Agile Project Management Process (Mahendra Kumar, 2015).

The APM method enables the project to be modified immediately as each iteration examines and evaluates its needs. In addition, APM follows a functional management style; thus, it focuses on determining the scope and needs of a project by prioritizing the list of project functions and value-based objectives, such as increased revenue or market share. APM significantly focuses on collaborative development and management to achieve outcomes, get customer feedback, and improve (Hass, 2007).

TPM Vs. APM

In TPM, time and cost are fixed, and it often faces budget and schedule problems. It is more beneficial for complex and big projects like bridges, building construction, road, and other infrastructures where requirement changes are minimum after freezing the basic design. In contrast, Agile projects are time-boxed with a short iteration. The iteration lasts for two weeks to the one-month maximum. Agile project management focuses on

implementing the client's feedback and periodically reviewing the product. Customer collaboration is a vital factor in agile. It does not follow a plan blindly and responds to changes quickly. Table 5 details the comparison between agile and traditional project methods.

	Agile Project Method	Traditional Project Method
Requirements analysis	Iterative approach	Detailed requirements profile
Modification costs	Low	High
Development direction	Can be changed at any time	Fixed
Testing	After each iteration	After Completing the development phase.
Customer interaction	High	Low
Technology	Uncertain	Well, Understood
Project scaling	Low to medium project size	Extensive projects

Table 5: Agile and TPM Comparison (Linke, 2019)

Customer satisfaction is the highest priority for any business; the agile method ensures customer satisfaction, and they will be involved from the beginning of the project (Linke, 2019).

Success Rates of APM and TPM:

Most recent Standish Group Chaos Study from 2020 shows that Agile Projects are 3X more likely to succeed than Waterfall projects. Moreover, Waterfall projects are 2X more likely to fail. Below figure 16 shows the 2020 survey results of the Standish group. Agile projects are more successful compared to traditional waterfall methods.

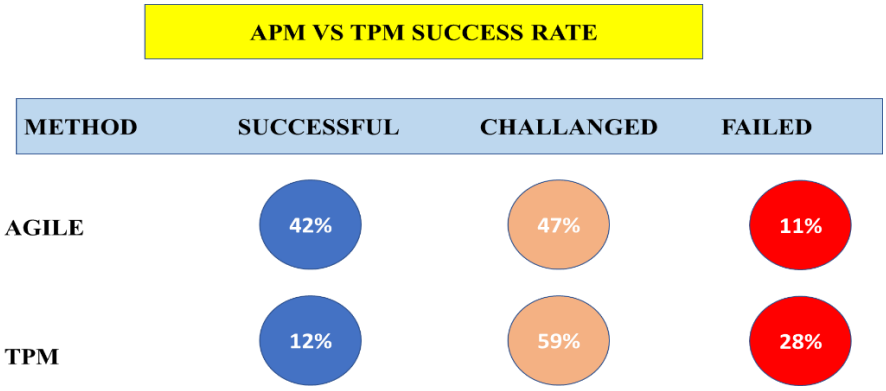

Figure 16: Success Rate survey of APM Vs TPM (Standish, 2020).

Agile is a powerful tool for software development, providing benefits to the development team and several significant business benefits to the client. Agile helps project teams deal with many of the most common project pitfalls (such as cost, schedule predictability, and scope creep) in a more controlled manner. By reorganizing and re-envisioning the activities involved in custom software development, Agile achieves those same objectives in a leaner and more business-focused way (Segue Technologies, 2015).

In a hybrid approach where professionals use both agile, and waterfall phase gate reviews are still relevant and required. Professionals recommended incorporating time-limited sprints into phases in the hybrid approach phase gate review to create working iterations of products and features throughout a development cycle.

Digital transformation is a complex process of several strategic project execution; professionals can use agile and hybrid methods. As such digital transformation is many times expensive; hence it is recommended to start early, fail early, apply lessons learned and use an iterative process which is more of agile approach. At the same time the agile principle discusses the maximum duration of each sprint and delivery of workable software, which may not be sometime possible in a long transformation process. Professionals will weigh the application of both APM and TPM and decide suitable method.

3.5 Driving Factors

Digital transformation is high on the agenda of CEOs of many firms, and organizations are investing heavily to implement it at a faster phase. However, understanding the need for a particular change, is necessary before implementing it. Digital transformation requires heavy investment and commitment from the top management. Hence organizations must analyze and identify the drivers for digital transformation pertaining to their firms. This also avoids using technology just for the sake of its availability. It is essential to understand why the change is required and how it can be achieved.

Several scholars, consultants, and industry practitioners have done extensive work identifying digital transformation drivers. Ali (2019), in his research work, digital transformation framework, excellence of things (EOT) for business excellence, performed qualitative interviews with semi-structured questions to understand the enablers and drivers of digital transformation. Ali's (2019) analysis identifies six main drives that enables digital transformation. These factors are cost reduction, employee empowerment, the culture of trust, learning and innovation, organizational culture, and digital disruption. Cost reduction is the objective of any corporate leaders, who intend to take any possible measure to optimize the expenditure. Drivers like digital disruption, learning, innovation, and culture trust indicate that leaders were deeply concerned with emerging new technologies and needed to cope with the market competition. However, customer experience was not listed as an element in the driver lists. As per Javadi (2022), a great reason to undergo digital transformation can be an opportunity to improve the customer experience. Javadi (2022), further elaborated that companies can deliver compelling products and services by using advanced technologies that help to improve customer satisfaction and relationship. The main goal of any firm is to reach out to a more significant number of customers and open new revenue streamlines; this objective can be achieved by implementing digital transformation (Javadi, 2022).

Verina and Titko (2019), empirically studied the factors driving the digital transformation process in business. The study reveals nine driving factors:

1. Emergence of new markets and new business opportunities

2. Development of e-business

3. Increased competition

4. Customer requirements and increased needs

5. Progress in technologies

6. Digitization of the tasks and processes

7. Increased co-operation between old-timers and digital natives

8. Executive support

9. Recognition of the role of digital technologies among the leaders

Findings like recognition of digital technology, technological progress, and e-business were similar to Ali (2019) findings of digital disruption. Customer needs and requirements align with an observation from Javadi's (2022) customer experience. Increased co-operation and executive support were new findings; in the researcher's opinion, these elements are more relevant to success factors.

Yokogawa (2021) categorizes the driving factors into two main groups: market drivers and technological drivers. In the market driver category, end-user commodity price (e.g., oil and gas), which in turn forces capital expenditure control, is considered one of the major drivers. In addition, aging operation and maintenance workforce, safety, quality, and environmental regulations are considered as market-related factors prompting the process and manufacturing firms to transform their operation and business models. Regarding technological drivers, Yokogawa (2021) details cloud, big data, artificial intelligence (AI),

and IT/OT convergence as the driving factors for digital transformation. These technologies can provide real-time customer insights and guidance to predictive breakdowns and smooth operations. Technology has increased the customer experience and expectations.

The Findings of Yokogawa (2021), are in line with Verina and Titko (2019), Ali (2019), and Javadi (2022), conveying most the similar elements. However, the researcher observed that most drivers are related to IA company customer digital transformation. The researcher's objective is to find internal and external drivers leading to organizational internal transformation and externally support their customer firm's transformation.

3.6 Target Areas for Digital Transformation

Target areas are the fields that leaders and digital transformation teams need to focus. Several scholars and industry professionals have worked to identify these focus areas, which are pivotal for the success of digital transformation in the organization.

Action Fields Illustration by Bumann and Peter (2019)

Bumann and Peter (2019), performed an empirical study of the action fields of digital transformation. Bumann and Peter performed a comparative analysis of digital transformation models and frameworks, which involved the study of 18 scholarly articles. The analysis resulted in the six dimensions that can be used in a cross-industry digital transformation framework. As shown in figure 17, the six dimensions are business strategy, the organization, culture, technology, the customer, and people.

Bumann and Peter (2019), detailed the theoretical concepts of strategy and emphasized building a robust digital strategy for successfully implementing digital transformation. As per Bumann and Peter (2019), it is imperative to have a formulated strategy. It is vital to ensure the availability of sufficient and competent resources, and strategies must be regularly revisited, updated, and tested (Kane et al., 2016; Peyman et al., 2014; Schumacher, Erol and Sihn, 2016).

Scholars recommended appointing a chief digital officer (CDO) in the organization domain to spearhead the digital transformation journey and encourage cross-functional collaboration (Bumann and Peter, 2019). Corporate culture is an essential element and its focus on future plays a critical role in the digital journey. Hence it is recommended to create "a passionate and pioneer culture", encouraging the workforce to be innovative in their activities and develop an agile work culture (Bumann and Peter, 2019; Schlaepfer et al., 2017).

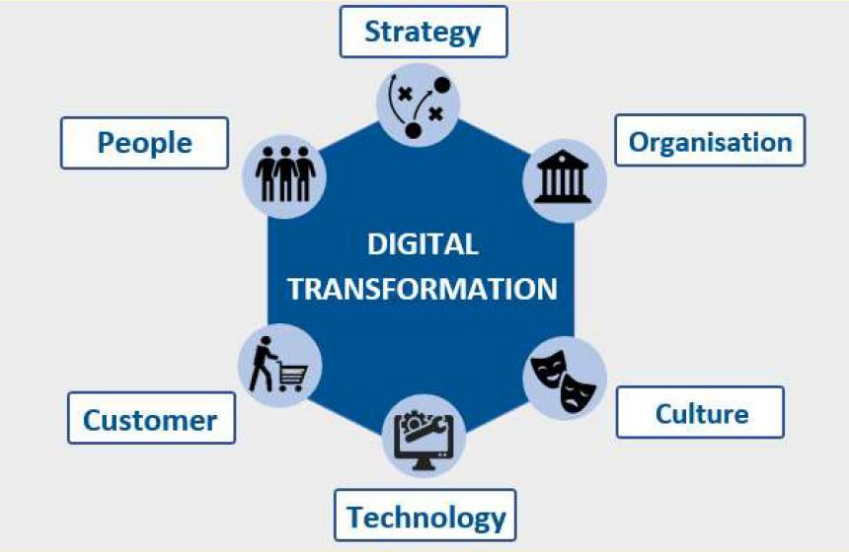

Figure 17: Digital Transformation Action Fields (Bumann and Peter, 2019).

At the same time, technology is an important dimension, and digital transformation success depends on the organization's approach toward using new technologies. Conservative leaders that follow the market will use widely validated tools and technologies. In contrast, innovative market leaders exploit emerging technologies like artificial intelligence, the internet of things (IoT), and deep learning. These leaders are ready to take risks (Hess et al., .2016; Ismail, Khater, and Zaki, 2017).

Customer and regular interaction with customers and organizations are of utmost critical for the execution of digital strategy; hence companies and management should ensure consistent face-to-face or digital channel interaction and design appropriate customer

experience (Bumann and Peter, 2019). Andersson et al. (2018), argue that employees with the required skill set are essential for digital transformation apart from technology.

To summarize the six-action field illustrated by Bumann and Peter provides a framework for firms to master their digital transformation journey.

A Framework of Action Fields (Gimpel et al., 2018).

Gimplel et al. (2018), after reviewing the previous scientific literature, interviewed executives of different organizations and developed a holistic framework for action fields, as shown in below figure 18.

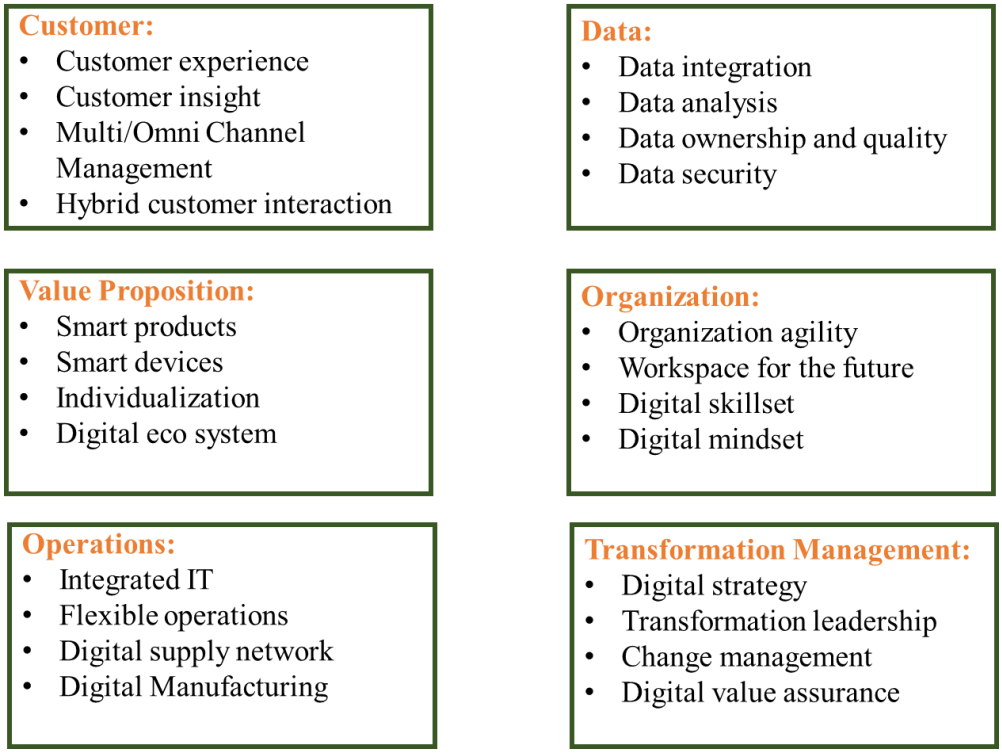

Figure 18: Action Fields for Digitalization (Gimple et al., 2018)

As per Gimpel et al. (2018), a company's digitalization requires mastering six action fields; customer, data, value proposition, organization, operation, and transformation management. Each action field has four sub-elements called action items. Scholars argue

that organizations can develop holistic digital transformation roadmaps for their firms by focusing on these action fields and items.

Compared to Bumann and Peter (2019) framework, the Gimpel et al. (2018), the framework has similarities; both consider the customer and organization as the action field. Data and technology, strategy, and transformation management are similar terminologies. In Bumann and Peter (2019) framework, emphasis was also given on people, whereas the people part did not find importance in the Gimpel et al. (2018) framework. The value proposition indicated in Gimpel et al. (2018) framework is the critical action field. Organizations should enrich their value proposition via intelligent products and smart services, which bring value to the customer and customer experience.

Finally, both scholars' frameworks are generic, meaning that organizations must decide whether to completely redefine their action fields and digital strategy or enrich their existing strategy with digital topics in the digital era. By utilizing the previous work on the other organization or generic modules, a holistic action field framework for IA companies is required.

3.7 Digital Maturity Analysis

Maturity models are also called digital transformation capability models, which are vital for the transformation journey. Maturity models render clarity on organizational capabilities, and the framework can be used to plan and achieve organizational objectives (Gill and VanBoskirk, 2016). Gudergan and Mugge (2017) advocate developing a maturity model that would educate employees throughout the transformation. Maturity assessment includes dimensions like strategy, organization, people, culture, technology, etc. (Albukhitan, 2020). Mäkelin (2019), proposed a digital transformation maturity model (DMM). Similar to strategic management, the contribution of academicians for maturity analysis is less than that of practitioners and consultants.

Figure 19: Deloitte Digital Maturity Model (Deloitte, 2018)

DMM represents the cross-organizational digital maturity model, and as shown in figure 19, it uses five critical aspects, namely, customer, strategy, technology, operations, and culture, to assess digital capability (Felch et al., 2019). There is a common understanding among consultants for maturity measurement methodology. Accenture's "Digital Capacity Assessment" (DCA) considers five dimensions of strategy, leadership, culture, product, and service for maturity measurement. In contrast, DMM uses the customer, strategy, technology, organization operation, and culture for the assessment. KPMG's "Digital Readiness Assessment" assesses maturity concerning transformation intensity and operational effectiveness (Felch et al., 2019).

As per Raut (2020), digital maturity levels can be assessed at five levels, illustrated below in figure 20. Digital transformation is becoming mainstream, and even mature organizations are grappling to adjust and evolve. The maturity framework enables organizations to self-assess their level of maturity. Assessment helps companies identify the current digital maturity level and determine which activities are going well and where to improve. In other words, this will help find the gaps between the organization's digital aspiration and current status and develop the necessary skills and infrastructure (Raut, 2020).

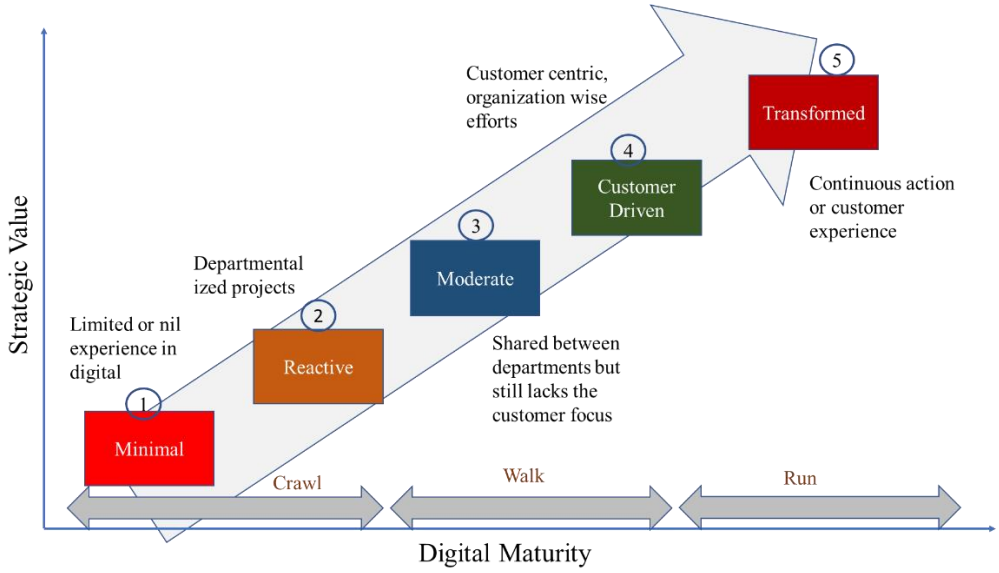

Figure 20: Digital Maturity Model (Raut, 2020).

Raut (2020), suggested using of nine categories, to gauge the maturity level of the organizations. Nine categories of measurement are listed below in figure 21.

SL NO	Categories	Description
1	Customer centricity	Are you providing experience to customers on their preferred channels, online offline, anytime on any device.
2	Strategy and roadmap	How the business operates or transforms to increase its competitive advantage through digital initiatives which are embedded within the overall business strategy
3	Leadership	How leaders perceives the digital transformation
4	Culture	Do you have the organization structure and culture to drive the digital top down.
5	Technology	Relevant tools and technology to make the data available across all the systems
6	Partners	Are you utilizing right partners to augment your experience
7	Innovation	How employees are encouraged to bring the continuous innovation to how they serve the customers
8	Execution	Digitizing the and automating the processes to enhance the business efficiency and effectiveness
9	Reporting and monitoring	Which measurement are in place for digital

Figure 21: Digital Maturity Assessment Categories (Raut, 2020).

Despite the different approaches, Deloitte (2018) and Raut (2020) maturity levels focused on customer, strategy, technology, operation, and culture.

3.8 Digital Transformation Frameworks

"Digital transformation frameworks distinguish between successful and unsuccessful transformation efforts. As a result of the fact that despite increasing discussion and focus on the benefits of digital transformation, many businesses do not adopt a business-focused digital transformation framework. IT can be found to be doing things one way, while the business does things another, causing organization to suffer severely as a consequence."

Rob Liewellyn: Founder and CEO of CXO transformation education platform.

Section 2 of the literature review exhibits that digital transformation is not just plug-in software; it is a complex process requiring a more systematic strategy and executable framework.

The process of digital transformation is intricate. Strategy is more important than execution; a well-prepared and executable digital transformation framework can make the transformation achievable. Consultants and industry practitioners view the framework as a method for analyzing a company to help it reposition itself in the digital economy. The digital transformation framework's objective is to develop the standardized process or methodology when planning and guiding the digital transformation. Before the digital era, subjective business strategy frameworks existed, whereas modern digital transformation frameworks were data-driven, data-powered, and predictive models (Mckeown, 2021). According to Schindlwick (2021), frameworks serve as a guiding beacon that equips the transforming team with a sense of progress toward the organization's goals and success. He further explains that when organizations start brainstorming ideas to solve their problems, these ideas usually will not align with the organization business context. When using disruptive technologies to solve problems, a significant risk always exists as companies invest a huge amount in developing or procuring the technologies. Hence all

companies are adopting a digital transformation framework as an effective strategy. Developing the framework has below benefits (Petrova, 2021).

1. Frameworks aid in analyzing the organization's core strategy, the problem it is attempting to solve, its short- and long-term business goals, innovation approaches, and the industry or business's maturity.

2. Frameworks are used to analyze customer requirements and expectations, product demand, and customer feedback.

3. Frameworks use collected data to evaluate competitors, identify competitors, market size, and customer coverage, and distinguish products and services. These statistics assist leaders in developing their own niche.

4. Frameworks are used to evaluate the capability of resources and leverage their skills to achieve business objectives.

Several digital transformation frameworks are available to aid transformation initiatives. Leaders must evaluate and select the appropriate framework for their organization, and they may even create a framework based on existing concepts. Frameworks are created by businesses, consulting firms, and academics. For the literature review, the researcher has chosen four frameworks: one from academia, two from consulting firms, and one from the industry. The selection of these frameworks was based on their applicability to digital transformation, as well as their richness in terms of research-based description, practical application, and industry relevance.

Digital Transformation Framework (Matt et al., 2015)

Matt et al. (2015), the framework for digital transformation is predicated on the notion that it serves as the foundation of an organization. Concepts of digital transformation link the comprehensive integration, prioritization, and initiatives of digitalization across businesses (kumann and Arpe, 2019).

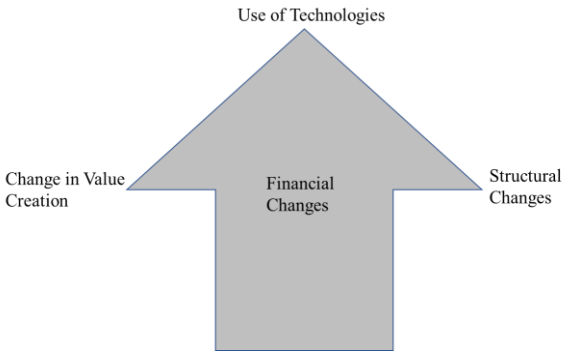

Figure 22: Digital Transformation Framework (Matt et al., 2015)

Matt et al. (2015) observed that, digital transformation has few common elements regardless of the organization. There were identified four common dimensions: the use of technologies, changes in value creation, structural changes, and financial aspects. Figure 22 depicts the interdependencies between the four elements of the transformation, which can be used in the capability and gap analysis of the organization when formulating the digital transformation strategy. The technology dimension addresses the enterprise's perspective on exploiting and utilizing new technologies. Organizations must decide if they wish to be market leaders in terms of technology usage and develop their own standard, or if they will adhere to already existing traditional standards and view new technologies as a means to achieve business objectives. Exploiting new technologies and being the market leader provides a competitive advantage and the chance to provide technology to other businesses (Matt et al., 2015). At the same time, exploiting the new technology can be risky, expensive, and time-consuming. Utilizing new technology frequently entails a second dimension, namely value creation. On the one hand, digital transformation impacts firms' value chains, while on the other hand, digital transformation strategies expand an organization's product and service portfolio. Due to the plethora of technologies in use and various forms of value creation, structural changes within an organization are essential for providing a solid foundation for new operations (kumann and Arpe, 2019). Changes to the organization's structure, processes, and competencies are referred to as structural changes. Leaders can decide between integrating a new operation into an existing system or establishing a separate subsidiary based on the magnitude of the change. Changes to the

organization's finances in the fourth dimension demonstrate its ability to fund digital transformation initiatives. The financial component is both a driver and a constraint for organizations; companies experiencing financial stress may delay or stymie the transformation process or seek external financing (kumann and Arpe, 2019). To ensure the successful implementation of digital transformation, all four components must be aligned and integrated

The framework is common to all industries; specific businesses and industries may require customization. Because digital transformation involves the rapid evolution of technologies, skill requirements also evolve rapidly. As digital transformation is still an emerging field, it may be difficult for businesses to find qualified personnel.

Mckinsey Digital Transformation Framework (7S and 4D Frameworks)

Mckinsey, Deloitte, Accenture, and KPMG have significantly contributed to digital transformation's theory and strategic development (Gill and VanBoskirk, 2016; Kane et al., 2015). These consulting firms have been partnered, appointed, or engaged in organization’s success stories. Ramnarayan and Mehta (2020) argue that despite hiring a consulting firm, it is essential to have an in-house team with the required competencies and that this is how L&T and Symphony achieved their transformation objectives.

Mckinsey's 7S theory is more popular, academically accepted, and critically evaluated (Demir and Kocaoglu, 2019; Bismark et al., 2018; Gokdeniz, Kartal, and Komürcü, 2017; Ravanfar, 2015; Salvarli and Dogu, 2019). Even though it was not developed in the era of digital transformation, the 7S framework is widely used by business and consulting firms and is considered a fundamental concept for any type of business transformation.

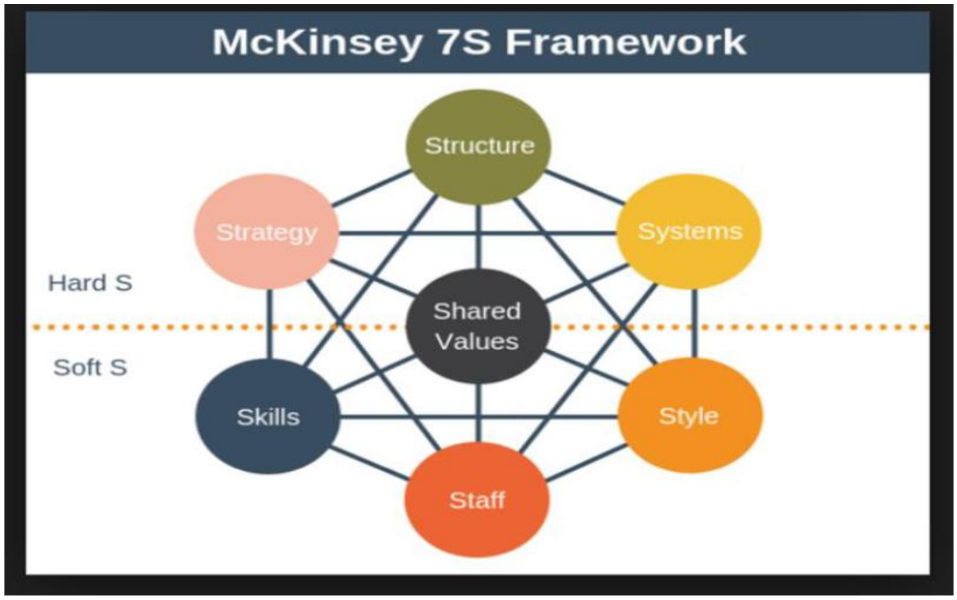

Figure 23: Mckinsey's 7S Framework (Demir and Kocaoglu, 2019; Ravanfar, 2015)

In the early 1980s, Julien Philips, Antony, Robert Waterman, and Tom Peters contributed to the development of the Mckinsey 7S model. While developing digital transformation strategies, academics and businesses widely apply the 7S model. Figure 23 depicts the 7S framework, consisting of seven factors that can be further classified as hard and soft factors (Demir and Kocaoglu, 2019). Hard factors are primarily associated with organisational structure and procedure, whereas soft factors are associated with culture (Ravanfar, 2015). In this framework, shared value is viewed as a crucial and central success factor.

Mckinsey has developed a proprietary digital transformation framework known as the "4D" framework. Figure 24 depicts the "4D" model, which consists of four elements: Discovery, Design, Deliver, and De-risk.

Figure 24: Mckinsey's 4D Framework (Coundouris, 2020; Mckinsey, 2016)

In the discovery phase, leaders shape the organization's digital ambition, strategy, and business cases using industry and business insights (Mckinsey, 2016). Design is the phase of transforming "thoughts" into "things" by reinventing and prototyping the newly discovered capabilities (Coundouris, 2020). Mckinesey emphasises a customer-centric, test-and-learn methodology. At the conclusion of the design phase, a transformation plan blueprint will be developed (Mckinsey, 2016). The delivery phase focuses on delivering the transformation initiative formulated in the design phase (Mckinesey, 2016). In the De-risk phase, McKinsey advised businesses to reinvest profits by restructuring the change program, resources, and commercial model to reduce operational and financial risks (Coundouris, 2020). This model is more suitable for start-ups than for well-established businesses using the conventional system, which finds it difficult to implement. However, it would have been beneficial to include the user guideline and academic data evidence required for its formulation and implementation.

Cognizant's Digital Transformation Framework (Corver and Elkhuizen, 2014)

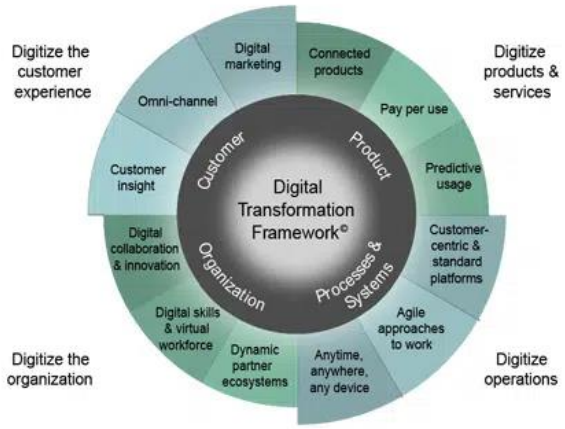

Figure 25: Cognizant's Digital Transformation Framework

(Coundouris, 2020; kumann and Arpe, 2019; Corver and Elkhuizen, 2014)

Cover and Elkhuizen are responsible for creating Cognizant's digital transformation framework (2014). The framework suggests beginning transformation with the customer by gaining a better understanding of the customer, enhancing customer service levels, and digitizing the customer experience (Udovita, 2020; Corver and Elkhuizen, 2014). Figure 25 demonstrates that the framework consists of four building blocks: (1) customer, (2) product, (3) processes and systems, and (4) organization, with the customer serving as the building's cornerstone. The customer building block is further categorized into sub-elements: (a) customer insight; (b) omnichannel and (c) digital marketing. These sub-components are intended to improve the customer experience, and for this purpose organizations can utilize digital technologies such as data analytics, CRM, and social media (kumann and Arpe, 2019; Corver and Elkhuizen, 2014). The product block is subdivided further into (a) connected products, (b) pay-per-use, and (c) predictive usage. The primary objective of digitizing products and services is to improve the customer experience and provide industries with services such as pay-per-use (Corver and Elkhuizen, 2014). The third element of process and system, are further subdivided into: (a) customer-centric and standard platforms; (b) agile work methodologies; and (c) anytime, anywhere, and any device. To optimize the various functions, process, and system elements concentrate

primarily on the customer and business process (kumann and Arpe, 2019). The final element, organization digitization, is classified as follows: a) dynamic partner ecosystems; b) digital skills and virtual workforce; and c) digital collaboration and innovation. Digitizing the organization focuses primarily on internal transformation and the development of digital skills among employees. Software robots, commonly known as bots, can be utilized to create a virtual workforce (kumann and Arpe, 2019).

Cognizant's digital transformation is a customer-centric strategy that could aid other companies in their efforts to develop digital strategies and new business models based on digital capabilities. After examining this framework, it can be deduced that a reverse engineering approach was created to explain the successful transition of organizations to digital business models (Udovita, 2020). However, the framework does not provide a specific guideline for its formulation and implementation. Framework is based on the programmatic method but needs more academic information (kumann and Arpe, 2019).

IA Company Digital Transformation Framework (Yokogawa, 2021)

Yokogawa, a pioneering IA company, proposed the digital transformation framework in an ebook (Yokogawa, 2021), as displayed in figures 26 and 27 below. As a provider of system solutions, Yokogawa primarily enables the transformation journey of the customer in the process and manufacturing domains.

Figure 26: Yokogawa Digital Transformation Framework (Yokogawa, 2021)

Digital Transformation Framework		
Discover	Design	Develop
Discover digital opportunities for organization and establish digital transformation blueprint.	Design a digital transformation business plan which is ready for implementation.	Develop an outcome-based digital transformation experience according to plan.
Activities: ► Organizational alignment ► Digital Maturity Assessment ► Opportunity Identification ► Initiative Prioritization	Activities: ► Stakeholder Alignment Sessions ► Business Process Mapping ► Analyse and Design ► Business Case Challenge Sessions	Activities: ► Program Governance ► Project & Change Management ► Build, Test and Production Release ► Agile Sprints & DevOps
Deliverables: ► Digital Transformation Blueprint ► DX Maturity Assessment Report ► 90 Days Action Plan	Deliverables: ► Business Case ► Digital Architecture Design ► Cybersecurity Philosophy ► Governance Framework ► Application Framework Design ► User Requirement Specifications (URS) ► Proof of Value	Deliverables: ► Digital Products and Services ► Training Program ► Documentation ► Sustainability Plan

Figure 27: Yokogawa Digital Transformation Detailed Framework (Yokogawa, 2021)

Yokogawa offers process industries a business partner who begins by aligning with their objectives, aspirations, and business strategies (Yokogawa, 2021). Discover, design, and develop make up the framework's three components. Yokogawa's engagement begins with a thorough understanding of the organization's objectives, identification of its challenges, and evaluation of the change's financial impact and complexity. In the discovery phase, the organization's available opportunities are identified, shortlisted, and their maturity level is evaluated before a transformation initiative blueprint that aligns with the organization's objectives is formulated. Next, in the design phase, a business plan for digital transformation is developed. Included in the design phase are stakeholder alignment, business case review sessions, and business process mapping. At the conclusion of the design phase, the organization will have produced deliverables such as the business case, the proof of value, and the digital architecture. In the final phase, a plan for an outcome-based digital transformation journey is developed. The Develop phase focuses on governance and control, project management, agile and DevOps methodology, testing, and the release of digital products and services (Yokogawa, 2021).

Comparison of Digital Transformation Frameworks:

This paragraph compares the studied frameworks; the researcher has selected one academic framework, two consulting firm frameworks, and one IA company framework. As reviewed in the literature, the contribution of consulting firms is greater than that of academics; therefore, selecting one academic framework, two business frameworks, and one industry framework will encompass the perspectives of various stakeholders. Below figure 28, a comparison of various frameworks is provided.

Conceptual Framework	Origin of Framework	Framework summary	Merits	Demerits	Framework Scientifically validated?
Digital transformation Framework by Matt et al (2015)	Academia	Use of technologies, changes in value creation, structural changes, and financial aspects.	Emphasis on core academic concepts. Defined procedures and processes, continuous re-evaluation of DT strategies.	Not officially trailed or validated. Does not provide details on governing elements except financial aspects.	No
Mckinsey 4D digital transformation framework	Business	Discover, design, deliver and di-risk.	Customer centric. Emphasis on re-investing and continuous learning.	No detailed guidelines. Lacks the governing and project management aspects. Complex to use.	No
Cognizant's digital transformation framework	Business	Customer, product, process and systems and organization	Customer centric. All process are based on customer value proposition.	No detailed guidelines. Lacks the governing and project management aspects. Complex to use.	No
Yokogawa digital transformation framework	Process and manufacturing industry	Discover, design and develop phases.	Industry focused. Framework details governance, project management aspects.	No academic and scientifically validated framework. Sustainability and continuous transformation aspects are missing	No

Figure 28: Comparison of Digital Transformation Frameworks (Own development)

The Matt et al., 2015 framework emphasizes core concepts such as integration, alignment, and dependencies between dimensions. Matt et al(2105) .'s academic framework was

designed and proposed, but has yet to be tested or validated as a convincing concept (Nwaiwu, 2018). Mckinsey, Cognizant, and Yokogawa all provide business-centric frameworks, but only Yokogawa provides details on transformation execution. Even though the Yokogawa framework covers execution details, it needs concepts of sustainability and how industries continue to explore and transform. Cognizant's and McKinsey's frameworks are more customer-centric, but they do not provide leaders with execution guidelines.

Why Digital Frameworks Developed are not Enough Researcher Findings

There is no universally accepted, robust framework for digital transformation that can be utilized to execute transformation initiatives. For the failure, digital transformation service provider and consultant blame clients, client company resistance, organizational culture, governance and management issues, top management commitment, etc., but consultant and service provider are equally accountable. Firms and digital service providers face the consulting services fatigue phenomenon, which contributes to the low rate of digital success. The exitance of excessive digital transformation frameworks demonstrates and confirms this phenomenon. Frameworks must be tailored to meet the needs of specific businesses. Formulating a framework for digital transformation does not guarantee success, but it should mitigate the risk of failure. Guidelines and success factors for the industrial automation domain are not explicitly covered by reviewed and analyzed frameworks. Coverage of the Yokogawa framework focuses on the customer journey as part of governances but not on complete strategic management and reinvestment for continuing transformation initiatives. Since new technologies are constantly evolving and entering the market, IA firms must continuously analyze external and internal conditions and reposition themselves based on demand, making digital transformation a continuous process. Therefore, instead of just a framework, IA companies will require a compressive strategic management framework.

3.9 Summary

This chapter presented empirical literature from the disciplines of strategy, strategic management, the strategic management process, digital strategy, and digital transformation. It examined the phases of strategic management and their significance. This chapter discussed waterfall project management, agile project management, and project management's role in digital transformation. Different digital transformation frameworks from academic, business, and industry perspectives were analyzed and contrasted with an emphasis on their significance. Finally, the framework's limitations and the need for strategic management were discussed.

4 CHAPTER 4: RESEARCH DESIGN AND METHODOLOGY

This chapter describes the method of research design. Research methodology systematically addresses the research problem (Kothari, 2008). This may be implicit as a science of studying how research is carried out scientifically. There is no single-fit research methodology; therefore, each researcher must develop his or her own. While developing the methodology, the researcher must ensure that the research process is conducted in a way that is comprehensible and evaluable (Trochim et al., 2016). The Saunders Research onion, detailed in figure 29, is utilised to describe this research framework. The research methodology, strategy for development, data collection techniques, and data analysis are discussed.

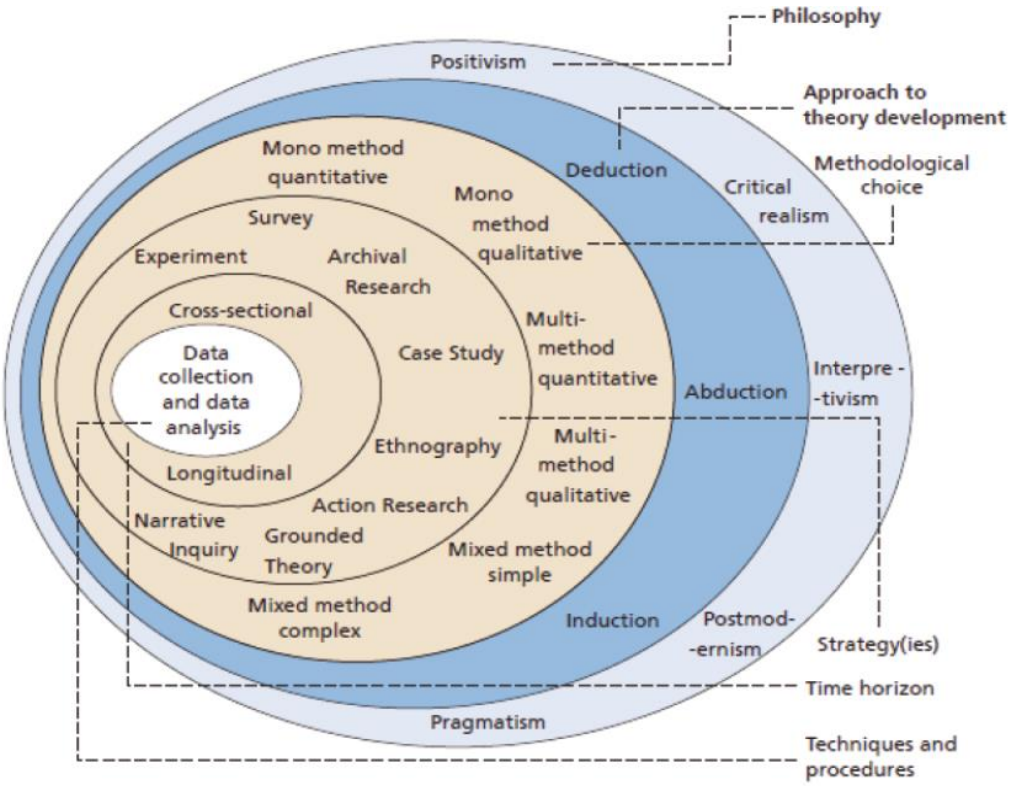

Figure 29: The Research Onion (Saunders et al., 2019)

Research onion is a practical and well-organized structure that can be applied to the development of any research project. Each layer of the diagram provides researchers with

guidelines for selecting an appropriate framework, which is extremely useful. This framework also provides a comprehensive description of the diverse methods and techniques available for data collection, analysis, delivery, reporting, and conclusion of the research (Saunders, et al, 2019). The proposed research design for this project is depicted in figure 30 below. After a comprehensive analysis of Saunder's research philosophy, a research design is developed.

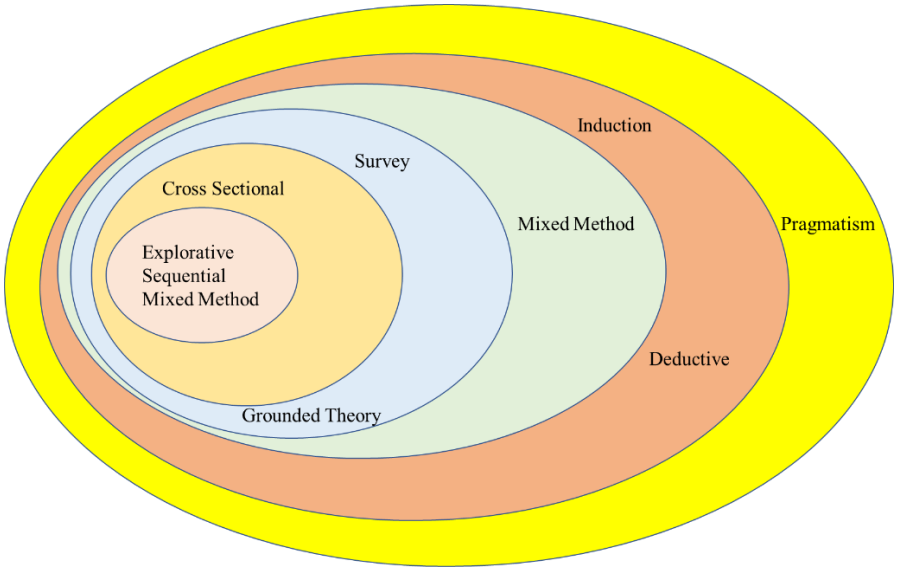

Figure 30: Research Onion Design for this research (Saunders et al., 2019)

4.1 Research Framework

The research philosophy is the basis of the research study, as it describes the set of beliefs used to construct the investigation. It is the process by which data is collected, analysed, and utilised. There are three assumptions in research: ontology, epistemology, and axiology (Saunders et al., 2019).

Ontology is the assumption used to express reality. It concerns the nature of reality and what we are able to know and comprehend. It aids in bridging the gap between reality, our perception of it, and how this affects various societal aspects and people's behaviour (Saunders et al., 2019; Eriksson and Kovalainen, 2015).

The topic of epistemology is "how" we can comprehend the situation, reality, and limitations in order to acquire knowledge. It entails evaluating how the world can be known and communicating information to others (Saunders et al., 2019). It is an oversimplification to many scholars, but it is a valuable starting point.

The axiology research philosophy emphasises the importance of elements such as values and ethics. It is the study of value or, more precisely, the theory of value's nature. This assumption enables the investigator to understand and identify the role his or her values and judgement play in the collection and analysis of data, as opposed to excluding or controlling its influence (Saunders, et al, 2019; Alshamsi, 2019).

Every phase of the research procedure is predicated on assumptions about the knowledge base (Dudovskiy, 2016). Continue with the first layer after describing the assumptions outside of the research onion model. This contains a comprehensive analysis of the subcategories of axiology, epistemology, and ontology, reflecting the researcher's philosophical beliefs (Saunders et al., 2019; Alshamsi, 2019).

4.2 Research Philosophies

Positivism:

Quantitative scientific methods are preferred by positivists. In this perspective, only a singular, tangible reality can be fragmented and manipulated independently. In addition, it is highly objective and independent of how individuals live; therefore, subjective states are unimportant. Objectivity is genuine only if it is devoid of values and based on factual knowledge and the acquisition of information, prescribing opinions and feelings, etc. In addition, the positivist school of thought views social research as a neutral activity; from this perspective, research can be devoid of all bias and preconception, remain unaffected by emotional or attitude-based situations, and transcend appearance and common sense. In addition, it is the researcher's responsibility to quantify the gap between factual and believed knowledge (Alshamsi, 2019; Zikmund et al., 2013).

Realism:

Realists believe sociology can and should adhere to the logic and procedures of the natural sciences. In contrast to positivism, it interprets science differently. This philosophy relies on separating the human mind from what we perceive as reality. Both philosophies have the same approach, and their respective principles adhere to the same ideology. It assumes that a scientific method is used to generate knowledge. However, they are distinct in that realism asserts that scientific methods are fallible (Alshamsi, 2019). Dudovskiy (2016) suggests always being receptive to new investigative techniques because all theories are susceptible to scrutiny. It is required that we be amenable to investigation, as this demonstrates our ability to distinguish between various theories and locate the truth.

Interpretivism:

Interpretivism is a component of qualitative analysis that attempts to give meaning to the investigated reality (Alshamsi, 2019). Interpretivists favor qualitative humanistic methods. This qualitative theoretical perspective does not seek the mere description of the facts but their understanding; therefore, it seeks to provide attention to the social actor to comprehend his or her perspective. Therefore, the principle of analysis for this paradigm is the comparison of theory and reality. It also necessitates objectivity and evaluation skills for any action that promotes transformation (Venkatesh et al., 2013; Alshamsi, 2019).

Postmodernism:

Postmodernism is an indeterminate term that defies definition. Some philosophers attribute postmodernist doctrines to Nietzsche, while cultural theorists attribute postmodernism to the capitalist restructuring of the late 20th century. To subvert "grand narratives", univocity of being, and epistemic certainty, postmodernist thinkers developed concepts such as difference, repetition, trace, and hyperreality. In the "construction" of truth and worldviews, postmodern philosophy questions the significance of power relations, personalization, and discourse. Many postmodernists appear to deny the existence of objective reality and objective moral values (Patton, 2015)

Pragmatism:

The pragmatist philosophy is a vast subject. In pragmatism, the approach of researchers is more pragmatic. According to theory, truth and knowledge are inextricable from practical endeavors. Knowledge is not fixed in pragmatism; it is constantly questioned and interpreted. The researcher has a broad understanding of the observed and is capable of interpreting and determining the perceptions of reality from the subject's perspective, articulating an individual's experience with regard to the phenomenon under study. According to pragmatists, moral knowledge is derived from practices and the harms and benefits they confer on those involved. Also, it addresses abstract and subjective aspects of the investigated phenomenon. It must be noted that pragmatism does not adhere to or restrict itself to a single philosophy (Alshamsi, 2019). Pragmatism is also defined by its relationship to the practical and demands that all beliefs have a connection to the real world.

Pragmatism best suits our research endeavours. This exploratory study aims to identify the critical driving factors, action fields, and success factors for the success of digital transformation in IA companies and to develop a strategic management plan. A literature review was conducted to develop this concept further, adopting various concepts and points of view. After a review of the relevant literature, qualitative and quantitative analysis were conducted. This philosophy gave the researcher the freedom to develop in the most effective manner (Alshamsi, 2019).

4.3 Research Approach

Saunders et al. (2019) discuss the research methodology in the subsequent onion diagram layer. Research methods include both deductive and inductive procedures. To select the appropriate method for their investigation, researchers must have a thorough understanding of these methods and pay close attention to the purpose of their research (Alshamsi, 2019). The approach to research may be inductive, deductive, or a combination of the two, known as the abductive approach.

Deductive:

In the deductive method, we move from more general to more specific information; this method is also known as the "top-down" method. The deductive approach is concerned with "developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis" (Saunders et al., 2004). In this method, researchers build upon previously conducted research and further develop or expand it based on the existing theoretical foundation and interactive dialogue with industry practitioners.

Inductive:

In the inductive method, we move from specific information to more general and broad theories; this method is also known as the "bottom-up" method. It begins with observations, and theories are proposed at the conclusion of the research process as a result of observations. In the analysis, new data and patterns may emerge and be recommended for further investigation (Devault, 2019)

Deductive Vs Inductive:

Both methods have a divergent approaches to undertake the research. Both approaches have advantages depending on the phenomenon study and the research method (Hammersley, 2017).

Both deductive and inductive approaches to research differ in their approach. Depending on the study of the phenomenon and the research technique, both approaches have advantages (Hammersley, 2017).

In the deductive method, according to Dudovskiy (2016), the researcher first develops a theory about the research topic. After developing a theory, researchers develop a specific hypothesis that they are willing to investigate. In contrast, the inductive method proceeds from the most specific generalisations and theories to the most general ones. In inductive

reasoning, the investigator begins with specific observations and measurements before arriving at generalisations. These two methodologies are polar opposites and suggest distinct research foundations. By its very nature, the inductive method is more flexible than the deductive method, which is more focused on testing or confirming hypotheses (Greener, 2008).

According to Graneheim et al. (2017), an inductive approach seeks patterns. During data analysis, the researcher looks for differences and similarities in the collected data, which are separated into categories or themes at various levels of abstraction and interpretation. Consequently, the investigator progresses from the data to a theoretical understanding, from the concrete and particular to the abstract and general. However, inductive research is appropriate for qualitative investigation (Trumbull and Watson, 2005).

However, the deductive theory is regarded as a concept-driven approach. According to Schreier (2012), academics examine the implications of current theories or explanatory models regarding the phenomenon under investigation in light of the collected data. This approach, in contrast, evolves from a theoretical understanding to data; from an abstract and universal level to an existing and specific one. In addition, this method is commonly associated with the quantitative technique (Alshamsi, 2019).

Abduction:

The researcher will not move from theory to data (deduction) or data to theory using the Abduction method (inductive). Abductive is primarily a back-and-forth method that combines the advantages of deductive and inductive reasoning. Abduction begins with the observation of a "surprising fact" and then develops a plausible explanation for how this could have taken place (Saunders et al., 2019).

There are advantages to each of the three research methods; academics must select the method based on their research interests and desired method of investigation. This research will use both a mixed methodology and triangulation. The mixed method combines

quantitative and qualitative research techniques. As explained previously, inductive research is qualitative, while deductive research is quantitative; both approaches were utilised in this study.

4.4 Research Methodological choice

The next or third layer of the research onion is a methodological choice, also known as research choice. The methodological choice layer assists the researcher in deciding whether to combine quantitative and qualitative methods or use only one method. According to Saunders et al. (2019), there are three primary options: mono, mixed, and multi-method research designs, which can be combined with quantitative or qualitative methods (Saunders et al., 2019)

Mono Method (Mono Quantitative or Mono Qualitative):

In this method, the researcher determines whether to use quantitative or qualitative research based on the nature of the study (only one type can be applied). The primary characteristic of the mono method is that researchers cannot combine different types of research (Alshamsi, 2019). Even though it is a much simpler method, these mono methods can be used for our intended research, which will combine quantitative and qualitative approaches.

Mixed Method (Mono Quantitative and Mono Qualitative): (Selected method for this study):

In mixed methods research, quantitative and qualitative approaches are used for data collection and analysis within the same study. This method requires the integration of qualitative and quantitative data collection, analysis, and interpretation. The primary step in this strategy is the linking of data, or integration at the appropriate time. Integrating data for a specific purpose enables researchers to obtain a broader perspective of their research landscape, viewing phenomena through a variety of research lenses (Shorten and Smith, 2017).

When analysing the research choice from a broader perspective, it is vital to visualise mixed research as a continuum in which quantitative and qualitative approaches are combined, focusing more on one of these or giving them equal weight, allowing the researcher to utilise the strengths of both types of inquiry, combining them and attempting to minimise their potential weaknesses. This method requires additional time, manages large volumes of data, and conducts multiple analyses (Alshamsi, 2019). In light of the importance of the topic, the researcher has selected the mixed method (Qualitative and Qualitative mixed) despite its complexity and increased time requirements

Multi method (Quantitative and Qualitative):

Multi-method research is regarded as the most complex of the three research approaches. This strategy employs multiple methods to investigate the same phenomenon. This method employs both quantitative and qualitative research approaches. However, the study will only be analysed quantitatively or qualitatively, despite both types of data being collected (Saunders et al., 2019). It is asserted that this research method provides greater flexibility, comprehension, and explanation of reality.

Multi-method and mixed methods are extremely similar. However, there is a distinction between them. The multi-method approach divides the investigation into distinct fragments, each of which yields a unique result; each fragment was analysed with instruments independent of quantitative or qualitative methods. In contrast, the mixed method denotes a shared methodology that enables the researcher to produce a specific outcome (Alshamsi, 2019). This methodology is not employed in our studies.

4.5 Research Strategies

The Research Strategy is the blueprint for the planned investigational work (Saunders et al., 2019). As depicted in the research onion by Saunders et al. (2019), there are a number of distinct strategies; refer to figure 31 below for details. Each research strategy has advantages and disadvantages.

Figure 31: Research Strategies (Saunders et al, 2019)

Experimental research Strategy:

The experimental research strategy involves manipulating an unproven experimental variable under strict control. This allows one to describe the cause of a specific situation or occurrence. Besen-Cassino (2017) suggests that academics can influence the up-and-down movement of a variable and its effect on observed behaviours. The scientist manipulates the experimental variable consciously and then observes the outcomes of controlled situations (Alshamsi, 2019). This strategy is applicable to all research fields and typically involves considering a small number of factors. Each factor relationship is evaluated in light of the anticipated research outcomes (Saunders et al., 2019).

Surveys:

The quantitative research method collects data through the use of surveys. Survey methodology takes into account the sample's representation of the population (Bryman, 2011). There are three distinct characters available in the survey (Kraemer, 1991). Initially, specific characteristics of a given population will be quantified. Different media can be used to distribute survey questions; survey monkey and Google Form are two examples. Researchers contacted target professionals or individuals to request their participation in a

survey. The survey was used to collect data, the research uses a sample of the population, and the findings will be generalised to the entire population (Glasow, 2013).

There will be two parts to the survey research: independent variables and dependent variables. Questions will be developed for both categories. Before conducting the survey, the researcher must develop a model that identifies the expected relationships between dependent and independent variables. The research hypothesis is evaluated in light of the observed phenomena (Glasow, 2013).

Grounded Theory:

Grounded theory is predominantly an inductive qualitative research strategy. In this case, the researcher may conduct face-to-face interviews with prospective candidates via telephone or other electronic media. The collected interview data can then be transcribed, coded, and grouped appropriately to determine the common factors exhibited by respondents. The grounded theory method generates investigation outcomes from completed research. Data is not examined beforehand to determine if it fits into the existing framework (Flick, 2011). Grounded theory is prevalent in the social sciences (Bryman, 2016).

The grounded theory requires the researcher to avoid previously learned information and concentrate solely on the data. Consequently, this theory offers a fresh viewpoint on the inductive method. In this instance, data analysis is a process of constant comparison that generates explanatory concepts and theory. In addition, this theory will not seek to generate formal theories but rather theories about the subject. In this regard, the researcher intends to prove his or her ideas to generate grounded theory, but only to demonstrate their plausibility. (Alshamsi, 2019).

Archival Research:

Utilizing existing materials, archival strategy conducts research. This strategy may involve various applied activities and a systematic review of the relevant literature. Existing research is analysed and consolidated to determine the sum of knowledge on a particular study, or the application of existing research to specific problems is investigated. This method ensures the smoothest possible research of textual materials and documents produced by and about organisations (Ventresca and Mohr, 2017). This method is used to supplement other research techniques, such as field and survey methods. Thus, the archival technique could be used to analyse digital documents such as emails, databases, and websites (Alshamsi, 2019).

Case Studies:

Case studies are a common research method in the fields of health and social sciences, involving an exhaustive search and inquiry process. It also contains a systematic examination of multiple cases. In some instances, other industry cases are studied. It will assist us in comprehending the circumstances of the industries chosen for research, as well as their unique phenomena, current state, and required improvement. Case studies will provide insight into particular instances and can be utilised to establish the cultural context. Compared to other types of empirical research, this method is classified as qualitative because it focuses on the exhaustive examination of a phenomenon rather than the statistical analysis of existing data (Silverman, 2013).

Action Research:

The term action research was coined by author Kurt Lewis and first used in 1944. The strategy outlined a type of research that combined an experimental approach to social science with social action programs that addressed the most pressing social issues of the time. Lewis argued that theoretical advancements and social change could be accomplished simultaneously through action research (Alshamsi, 2019). In addition, action research offers additional benefits derived from the practice itself: it allows for the generation of

new knowledge for the researcher and the groups involved, the mobilisation and strengthening of organisations, and the most effective use of available resources based on a critical analysis of change needs and options.

Ethnography:

Ethnography involves observing people closely, analysing their cultural interactions, and determining their significance (Bryman, 2016). The purpose of ethnography is to conduct research from the perspective of individuals. Researchers observe individuals in order to comprehend their culture and behaviour in their environment. The process required continued observation, participation, and patience. Data is analysed according to social conditions, time, ideology, interests, and academic formation using observed inputs.

Quantitative and qualitative methods will be used in this research; therefore, the most pertinent research strategies are grounded theory for qualitative and survey for quantitative.

4.6 Research Time Horizons

Two types of time horizons exist, longitudinal and cross-sectional studies, which are depicted in Figure 32.

In the longitudinal study, researchers repeatedly examine the same subject to detect any changes that may occur over time. In this study, time could be as brief as a few weeks or as extensive as several years. In this type of study, the researcher had no interaction with the subjects. Longitudinal studies are primarily utilised in the fields of economics, epidemiology, and medicine (Hasa, 2020).

In the cross-sectional study, researchers collect data from various individuals at a particular time. Using the collected data, academics can simultaneously analyse multiple characteristics such as age, gender, income, etc. This type of study provides a glimpse of the prevalent characteristics of a population and can provide information about what is

occurring within the population at the present time. Thus, the cross-sectional method provides a snapshot of a population at a particular point in time (Hasa, 2020).

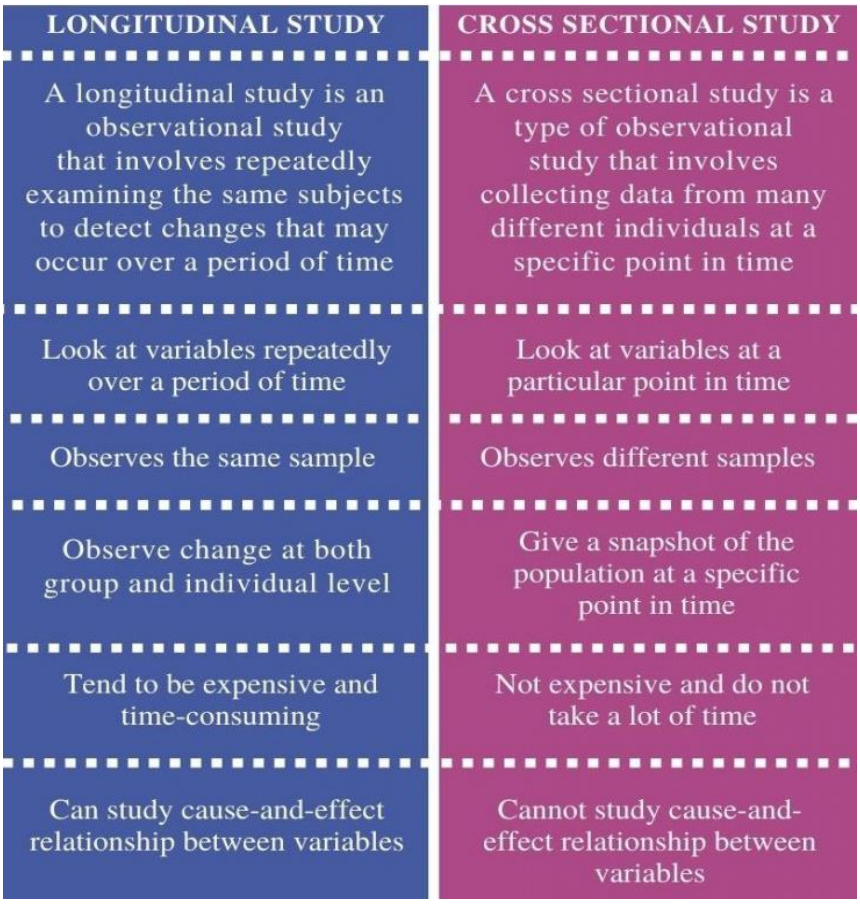

Figure 32: Longitudinal Study Vs Cross-Sectional Study

(Pedia.com, 2018)

4.7 Data Collection and Data Analysis Methods

The last two layers of the research onion are data collection and analysis. Prior layer methodological approaches are essential for data collection and analysis, it must be noted. The reliability and validity of the project will be significantly impacted by the nomination process during the project phase (Hammersley, 2017; Alshamsi, 2019). Information can be obtained from either primary or secondary sources (Sekaran, 2003).

Primary Data:

Academics collect primary data directly on the variable of interest for a specific research purpose (Sekaran, 2003). Included among the primary sources are individual interviews, focus groups, surveys, observations, and questionnaires. Interviews and focus groups can be conducted in person or via electronic media such as Skype, team meetings, or the telephone. One can conduct surveys using Google Form or SurveyMonkey. The primary sources provide a perspective from within the studied event or time period.

Secondary Data:

The secondary data collection method gathers data from existing sources (Sekaran, 2003). Secondary data are crucial for the majority of organisational research. This type of information comes from a source other than the current researcher. There are numerous secondary data sources, such as books and periodicals, government publications of economic indicators, census data, Statistical Abstracts, databases, the media, annual reports of companies, etc. Case studies and other archival records, which are examples of secondary data sources, offer a wealth of information for research and problem-solving. such data are primarily qualitative. In addition, secondary sources include schedules maintained for or by key personnel in organisations, the executive's desk calendar, and speeches delivered by them. However, a substantial portion of such internal data may be confidential and inaccessible to all (Sekaran, 2003).

The below table 6, compares both primary and secondary data collection methods.

BASIS FOR COMPARISON	PRIMARY DATA	SECONDARY DATA
Meaning	Primary data refers to the first hand data gathered by the researcher himself.	Secondary data means data collected by someone else earlier.
Data	Real time data	Past data
Process	Very involved	Quick and easy
Source	Surveys, observations, experiments, questionnaire, personal interview,	Government publications, websites, books, journal articles, internal records etc.
Cost effectiveness	Expensive	Economical
Collection time	Long	Short
Specific	Always specific to the researcher's needs.	May or may not be specific to the researcher's need.
Available in	Crude form	Refined form
Accuracy and Reliability	More	Relatively less

Table 6: Comparison between Primary and Secondary Data Collection

(Researchguides, 2018)

Quantitative, Qualitative and Mixed Methods:

With the need to quantify data, quantitative analysis methods are driven by the academic community. In this approach, research is conducted independently of the researcher, and data are utilised objectively to measure reality. This technique is utilised in response to research variables' relationship questions. It seeks explanations and predictions and aims to establish and validate relationships as well as develop generalisations that contribute to theory. After defining the problem statement, a hypothesis, literature review, and quantitative data analysis will follow. Quantitative research findings can be predictive, explanatory, and affirming. The researcher uses mathematical models to analyse data. The academics use inquiry techniques to ensure conformity with statistical data collection procedures (Williams, 2007).

In contrast to quantitative research, qualitative research employs a holistic approach and involves the elucidation of data. Leedy and Ormrod (2010) argued that the description of qualitative research is less structured because it formulates and develops new theories.

Qualitative research can also be described as an effective model that occurs in a natural setting and enables the researcher to develop a high level of detail by being intimately involved in the actual experiences being studied (Creswell, 2003). Under a poststructuralist paradigm, qualitative research is conducted. There are five qualitative research subfields: case study, ethnography, phenomenology, grounded theory, and content analysis. These five disciplines are representative of research that employs inductive reasoning and related methodologies. The premises of qualitative research are based on inductive rather than deductive reasoning. From the observational elements that generate questions, the researcher attempts to provide an explanation. The strong correlation between the observer and the data distinguishes qualitative research from quantitative research, in which the researcher is strictly removed from the phenomena being studied (Williams, 2007).

In contrast to quantitative research, qualitative research employs a holistic approach and involves the elucidation of data. Leedy and Ormrod (2010) argued that the description of qualitative research is less structured because it formulates and develops new theories. Qualitative research can also be described as an effective model that occurs in a natural setting and enables the researcher to develop a high level of detail by being intimately involved in the actual experiences being studied (Creswell, 2003). Under a poststructuralist paradigm, qualitative research is conducted. There are five qualitative research subfields: case study, ethnography, phenomenology, grounded theory, and content analysis. These five disciplines are representative of research that employs inductive reasoning and related methodologies. The premises of qualitative research are based on inductive rather than deductive reasoning. From the observational elements that generate questions, the researcher attempts to provide an explanation. The strong correlation between the observer and the data distinguishes qualitative research from quantitative research, in which the researcher is strictly removed from the phenomena being studied (Williams, 2007).

In the Mixed method, the researcher collects data for a single research study using both qualitative and quantitative methods (Creswell, 2003). In the mixed method, researchers collect and analyse quantitative data from the qualitative method and generate qualitative

narrative data. In this study, mixed methods are employed. Initially, qualitative data will be gathered through semi-structured discussion points and interviews with industry experts. Table 7 provides a comparison of qualitative, quantitative, and mixed methods. On the basis of the results of qualitative analysis, quantitative analysis can be conducted, or vice versa. In other words, mixed method research is an extension of quantitative and qualitative research methods, and both are essential (Johnson & Onwuegbuzie, 2004). The researcher employed mixed methods to highlight the benefits of quantitative and qualitative research approaches while minimising their drawbacks (Johnson & Onwuegbuzie, 2004). The development of driving factors, action fields, and technological tools is based on qualitative analysis, whereas success factors rely primarily on qualitative methodology and are then tested quantitatively.

	Qualitative approaches	Quantitative approaches	Mixed methods approaches
Purpose	Provides understandings and descriptions of participants' experiences	Tests and validates already developed theories	Provides greater insight, enables triangulation and complementarity
Philosophical assumptions	Constructivism	Positivism or post-positivism	Pragmatic
Strategies employed	Phenomenology, grounded theory, ethnography, case study and narrative	Surveys and experiments	Uses both qualitative and quantitative strategies
Methods employed	Open ended questions, observations	Closed ended questions, numeric data	Pluralistic methods from both approaches
Analysis	Themes and patterns are identified. Emphasis is placed on credibility, authenticity and trustworthiness.	Statistical procedures are utilised. Emphasis is placed on generalisability of findings, validity and reliability.	Practices from both qualitative and quantitative approaches can be used.

Table 7: Comparison between quantitative, qualitative, and mixed methods

(Gatumu, 2015)

As depicted in Figure 33, there are three common types of mixed methods: convergent parallel, explanatory sequential, and exploratory sequential. In this study, qualitative and quantitative methods are employed sequentially.

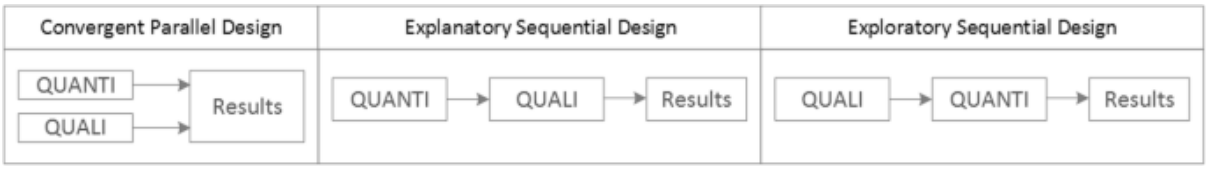

Figure 33: Mixed Method Design Approach (Kanadli, 2017)

4.8 Types of the Researches

At the outset of the project, the researcher must determine the type of research he will conduct. Three types of research exist: 1. Explorative 2. Explanatory 3. Descriptive. Each type has a distinct function, which must be determined at the outset. The table below provides a comparison of these three research projects.

Explorative:

This type of research is conducted when academics want to test the feasibility of conducting a more extensive study and determine the topic's "state of the art." It is used when very little research has been conducted on the chosen research topic. In this type of study, the researcher may wish to conduct exploratory work to determine the required method for data collection and the types of questions to ask participants to obtain the best results (Kanadli, 2017). According to Sekaran (2013), exploratory studies may also be employed when some facts are known but more data is required to develop a viable theoretical framework. Although other methods are also discussed, the exploratory method is deemed appropriate. Surveys, polls, interviews, focus groups, observations, online literature, and case study research comprise the exploratory method. It lacks a formal structure and consists of several general steps, such as identifying the problem, developing the hypothesis, and conducting additional research (Kanadli, 2017).

Explanatory:

The objective of explanatory research is to explain why particular phenomena function as they do. In this methodology, the researcher analyses the cause and effect of the phenomenon he is investigating. Typically, this research follows exploratory and descriptive research. Explanatory research includes in-depth interviews, literature, case studies, and focus group analysis (Subedi, 2018).

Descriptive:

The purpose of descriptive research is to describe or define the phenomenon. A descriptive study is conducted to determine the characteristics of the relevant variables in a situation (Sekaran, 2003). The study's primary objective is to provide a research profile or description of pertinent aspects of the phenomenon of interest from an individual, organisational, industry-oriented, or other perspectives.

Table 8 provides a comparison between all three research types.

	Exploratory Research	**Descriptive Research**	**Explanatory Research**
Research Approach used	Unstructured	Structured	Highly structured
Research Conducted Through	Asking research questions	Asking research questions	By using research hypotheses.
When is it conducted?	Early stages of decision making	Later stages of decision making	Later stages of decision making

Table 8: Comparative Table of Explorative, Explanatory, and Descriptive

(Theintactone, 2019)

4.9 Exploratory sequential Mixed method

After analysing the Saunders et al., Onion design, figure 30 depicts the selected framework. Figure 34 explains the chosen explorative sequential method for data collection and evaluation. The methodology and results of both quantitative and qualitative interpretations are displayed. For the analysis of success factors, the researcher employs an exploratory sequential method, while qualitative analysis is employed for other research questions.

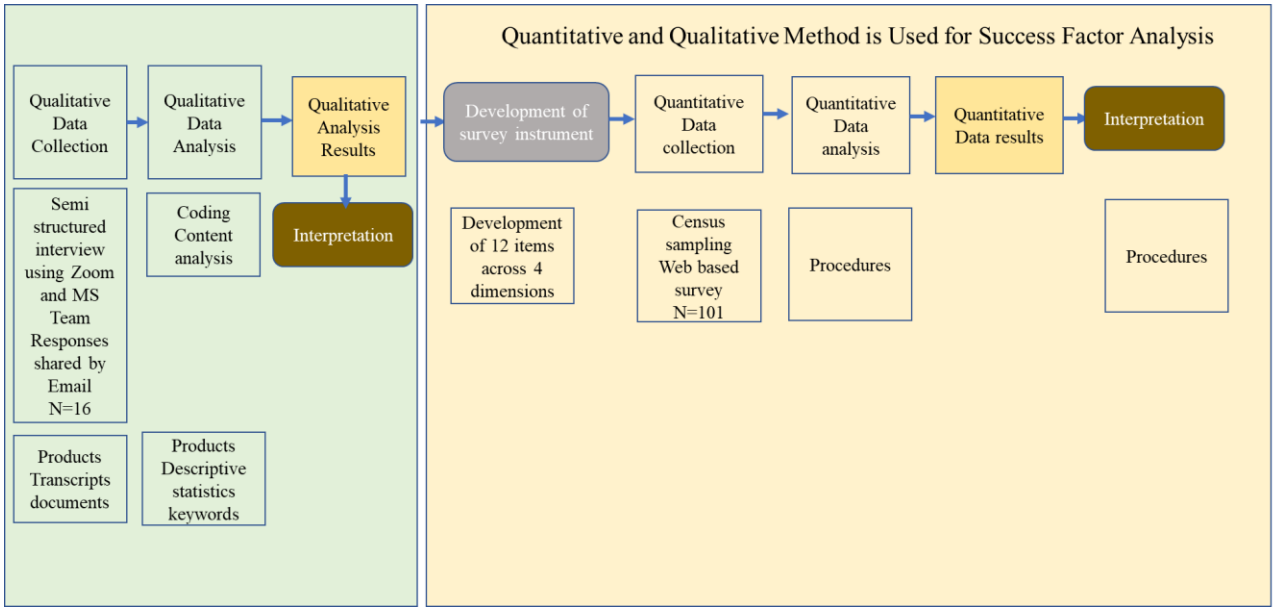

Figure 34: Explorative Sequential Mixed Method (Berman, 2017)

4.10 Triangulation

For the analysis of digital transformation success factors, researchers have adopted the triangulation method. Triangulation is a mixed methods research approach that combines qualitative and quantitative methods. It minimises the drawbacks that could result from using each method in isolation while maximising the benefits that each method offers (Creswell, 1994; Greene, Caracelli, and Graham, 1989). Triangulation is the use or validation of multiple methods or data sources to develop a comprehensive understanding

of the same phenomenon through research (Patton, 2002). Here, the researcher developed quantitative data using qualitative interview results as a starting point.

4.11 Summary

This chapter discusses the research design of Saunders et al. (2019). The research onion is analysed critically to determine its suitability for our research design. Researchers want to emphasise that all methods and approaches are acceptable and should be employed based on what is most appropriate for each individual research project. For this thesis work, the Saunders et al. (2019) research onion was designed after evaluating available options and analysing the pros and cons of each method, approach, and strategy holistically. The philosophy of Pragmatism and both inductive and deductive approaches are chosen. The researcher will employ both quantitative and qualitative methods. For data collection, interviews and surveys are used, and a cross-sectional approach is appropriate. The researcher used an exploratory, sequential mixed method for this study.

4.12 Population, Data collection and Analysis plan for this Project

Lola et al. (2016) define populations as the collection of identically observable elements, objects, or individuals.

The research employed both qualitative and quantitative methods, with the qualitative study's target population consisting of IA company executives. Since the participants were top-level management teams with busy schedules, the interview was scheduled in advance. All participants participated in one-on-one interviews; depending on participant preference, the researcher used in-person, Skype, Zoom, or Team meetings. Researchers distributed semi-structured open-ended questions in advance of the meeting, and the discussion was not limited to listed questions. Depending on the insight, the discussion occasionally went beyond the questions listed. The researcher recorded the interview with the participants' permission. For content analysis, a researcher utilized transcripts of interviews.

Quantitative testing is performed on additional success factors. The researcher employed a survey methodology and sent questionnaires to IA organizations' upper management and employees.

The research method used is detailed in below table 9.

SL No	Objective Details	Research Method
1	To explore the requirement of digital transformation for IA companies: Driving factors	Literature Review and qualitative analysis
2	Analyze the success and failure of digital transformation in other business areas and lesson learn.	Literature Review
3	Identify the areas that required to undergo transformation	Literature Review and qualitative analysis
4	Assess the current digital Maturity level of IA companies	Literature Review and qualitative analysis
5	To investigate the key digital technologies that have been adopted by IA companies for digital transformation	Literature Review and qualitative analysis
6	Identify the success factors	Literature Review, qualitative analysis and quantitative analysis
7	Develop the DX Framework/Strategy management	Literature Review and Review of Q1~6

Table 9: Research Methods selected for this Project (Own development)

4.13 Ethical Consideration

The researcher has a thorough understanding of the ethical issues associated with the research (Bell and Waters, 2018). The research has strictly adhered to research process regulations. The distribution of research questions to professionals was contingent upon obtaining their consent to participate; interviews and surveys were then conducted. All participants received a cover letter with their questionnaires to help them understand the student research, respondents' expectations, and the confidentiality of their responses.

The researcher will ensure that none of the professionals who participated in the survey are harmed during or as a result of this project. Additionally researchers ensured the validity

of the research and the accuracy of the data collected. These ethical considerations must be observed on a massive scale because they contribute to the report's absolute validity. The relationship between the quality of the report and ethical considerations is significant. The responsibility of the researcher is to conduct research in accordance with the objective and purpose. He is committed to adhering to the principles and transparently presenting the collected and analysed data to the university for additional validation of the work. The research complied with all terms, conditions, and defined procedures. Hence The researcher is confident that all ethical requirements for the research have been met and that the work adheres to ethical guidelines.

5 CHAPTER 5: RESULTS AND DISCUSSIONS

As described in the preceding chapter on research design, the researcher selected an exploratory sequential mixed technique. Initially, the researcher conducted a qualitative study to identify IA companies' driving reasons, action domains, maturity level, and digital technologies. In addition, a qualitative study is undertaken to comprehend the critical success elements for the effective implementation of digital transformation in IA firms. The quantitative study further supported the success elements. In this section, data analysis, results, and interpretation are presented.

5.1 Data Collection

The semi-Structured interview method has the potential to generate rich data; hence this was selected as a data collection tool. This method helps to explore the range of perspectives and develop a holistic viewpoint (Alshamsi, 2019).

The Semi-Structured Interview Method has the potential to yield rich data; hence it was chosen as the instrument for collecting data. This strategy helps to investigate a variety of perspectives and generate a holistic worldview (Alshamsi, 2019).

Participants were geographically dispersed and employed by several IA firms; therefore, it was impossible to travel and conduct face-to-face interviews, so it was decided to use electronic/digital technologies. The MS team/Zoom, or audio record, was used to record and transcribe the interviews; two candidates could not attend the online meeting and submitted their feedback via email. The interview covered the topics like factors driving the digital transformation initiatives in IA companies, business units or domains that are required to transform current readiness, and digital technologies adopted by the IA companies. The interview topic further discussed the critical success factors for successfully implementing digital transformation.

5.2 Population and Sampling

For this study, the researcher aimed to collect insightful information from specialized and selected industrial automation (IA) industry professionals working worldwide. Such purposeful participant selection is called purposive sampling (Oakshott, 2014). The researcher approached specific classes of professionals who could provide the required information and fit into the criteria established by the investigator (Black, 2010; Alshamsi, 2019). In this approach, potential participants are selected based on their knowledge and experience with respect to the research subject. In designing the sample, the following should be considered: the target population, parameters of interest, sampling frame, the appropriate sampling method, and the required sample size (Alshamsi, 2019). The best fit among the various purposive sampling categories is homogeneous sampling, which is defined as focusing on one specific subgroup where group members are very similar, sharing specific characteristics such as profession and pyramid work status (Saunders et al., 2012).

The researcher contacted professionals working in IA companies via LinkedIn and other social networks and friends' and colleagues' circles. Before contacting, a background check was performed to determine the suitability and required eligibility for this research. The individuals were initially sent an invitation letter that included a brief description of the research, ethical aspects of conducting interviews, the benefits of participating (i.e., sharing the summary of the results), and a list of tentative semi-structured points that were shared in advance. The invitation letter and tentative discussion points are available in Appendix 1. The researcher sent the request letter to 35 potential candidates, and 16 professionals accepted to participate in the interview.

In 16 individual professional participants, the sample included the chief executive officer (CEO), chief digital officer (CDO), vice presidents, department heads, project managers, and team leads responsible for digital transformation implementation in their respective organizations, customers of IA companies are also interview and is presented in Table 10. All the interviewees had considerable experience and knowledge in digital transformation,

its impact on their business, status, execution strategy, and lessons learned from previous projects and other industries. All participants are currently involved in transforming their organization.

SL NO	Responsibility of the interviewee in the organization	No of Interviews
1	Chief executive officers (CEOs)	2
2	Chief technical officers/chief digital officers/chief strategic officer	2
3	Vice presidents	2
4	Department heads/business unit heads	2
5	Project managers	3
6	Customers	2
7	Team Leads	3
	Total	16

Table 10: Breakdown of the participants interviewed for the research

SL NO	Total employees' size	No of interviews	Percentage
1	>5000	6	37.5
2	1000~5000	4	25.0
3	500~1000	4	25.0
4	<500	2	12.5

Table 11: Breakdown of the size of the organization

As presented in table 11, around 12.50% with less than 500 employees were from small and medium-scale enterprises, 25.00% had 500 to 1000 employees. Participants of 37.50%

were from very large-scale multinational companies, and 25.00% had 1000~5000 employees. Most IA companies require a lot off staff to work in engineering, manufacturing, and field services; hence it is natural to find more employees.

SL NO	Participants Education	No of interviews	Percentage
1	PhD	4	25.0
2	Masters	8	50.0
3	Bachelors	4	25.0

Table 12: Participants education background

As detailed in table 12, in the participant's group, 25.0% were Ph.D. scholars who completed either strategy, human resource, industrial engineering or digital transformation. Employees with master's degrees formed the majority group with 50.0%, and staff with bachelor's degrees stood at 25.0%. This group has a presentation from bachelor to Ph.D., which was required considering the complexity and need for insight from industry experts.

SL NO	Years of Experience	No of interviews	Percentage
1	>25 year	4	25.0
2	20~25 years	6	37.5
3	10~20 years	4	25.0
4	3~10 years	2	12.5

Table 13: Participants overall experience

As shown in table 13, of the selected participants, four professionals (25.0%) had over 25 years of industry experience, and six professionals (37.5%) had between 20 to 25 years of experience. The participant had a minimum of three years of experience. There were two

professionals (12.5%) with 3~10 years year and four professionals with 10~20 years of experience. The researcher examined all levels of experience to gain a complete understanding of the young to mature professionals. The researcher purposely considered a minimum of three years' experience as the subject required in-depth knowledge and hands-on execution experience.

5.3 Data Analysis

For qualitative data analysis, the researcher has used the content analysis method. Content analysis began as a tool for quantitative researchers, and now it is increasingly used in qualitative studies (Alshamsi, 2019). Content analysis is often considered the intersection between qualitative and quantitative research methods and is promising for the rigorous exploration of many essential but difficult-to-study issues of interest to management researchers (Alshamsi, 2019). The content analysis uses a set of procedures to make valid inferences from the transcript text. Fundamentally, the text analysis lets the researcher understand other people's cognitive schemes. In this method, word frequency has been considered as an indicator of cognitive centrality (Huff, 1990, cited in Alshamsi, 2019). Method refers to a group of words and underlying themes, and for instance, co-occurrences of keywords can be interpreted as reflecting the association between underlying concepts. The researcher creates the transcript documents in the content analysis coding, which may involve words, phrases, sentences, and paragraphs, and labelling the concepts. In this research, emerging themes were mapped and cross-verified with two colleagues working in the digital transformation domain.

Unit of Analysis

The unit of analysis is one of the essential elements in content analysis. The unit of analysis is the basis for decisions made during code development. It is the element on which data is inspected and observations are recorded and reported. The researcher should strive to retain the context necessary to derive meaningful data. While selecting the unit of analysis, the researcher should consider broad, contextually rich units to ensure the integrity of research

outcomes (Milne and Adler, 1999, cited in Alshamsi, 2019). The unit of analysis adopted for this study was the industry automation (IA) domain, and the embedded unit of assessment was the "individual employee."

5.4 Results and Discussions on Driving Factors

The industrial automation industry has experienced tremendous growth in the operation technology domain, and these players were pioneers of the Industry 3.0 era. The survey of the Precedence research group mirrors the IA field's enormous growth opportunities. Figure 35 depicts Precedence Research's industry survey of the IA market.

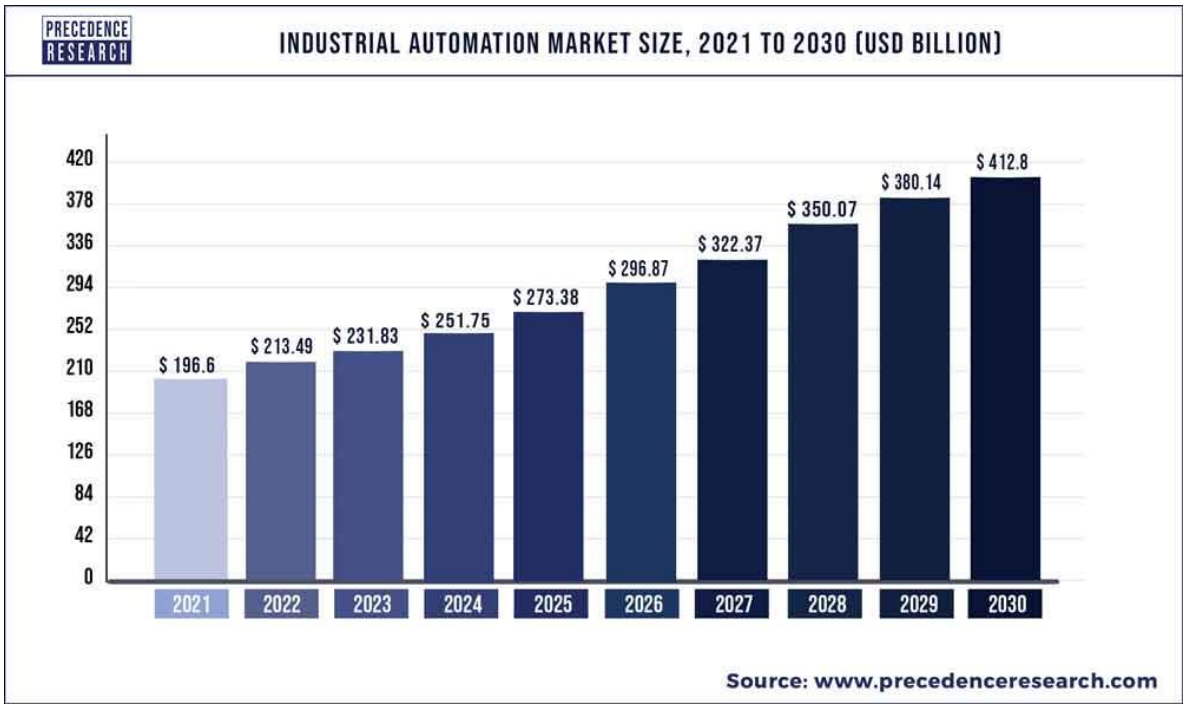

Figure 35: Industrial Automation Market Size (Precedenceresearch, 2022)

The worldwide IA market size was USD196,6 billion and is expected to breach USD412 billion by 2030 at a CAGR of 8.59%. The automation field, with the innovation of new technologies and reduced contact of humans with the manufacturing process and real-time data analysis, is helping the growth of IA companies. Automation companies like ABB,

Emerson, Honeywell, and Yokogawa dominate the market by developing new technologies and software systems.

With the emergence of new information and digital technology, IA companies have the opportunity to transform their industry and play an essential role in transforming the manufacturing and process industries. Like other business areas, leaders of IA organizations are investing heavily and rushing for digital transformation. It is critical that IA firms undergo self-digital transformation before becoming enablers for other industries. However, before implementing the digital transformation efforts, it is essential to conduct an in-depth analysis of the factors driving IA companies' digital transformation. Therefore, this section focuses on important factors that are driving the digital transformation of IA firms. This research analysis is based on the perceptions of 16 participants interviewed, and the findings are substantiated by relevant literature.

In the research data collection, during the interview with professionals, to capture the factors driving the digital transformation for IA companies, a question was raised, i.e. why are IA companies required to implement digital transformation? The study revealed the five key factors driving the IA industry's digital transformation. These factors are 1. people-oriented, 2. Market 3. Organizational 4. technological, and 5. Environmental and regulatory drivers. All these principal factors are discussed in detail, and this explanation addresses the research question: why IA companies required to implement digital transformation? This section addresses the objective "to explore the factors driving the digital transformation in IA industries."

SL NO	Driving Factors	Total number of interviewees cited. (N=16)
1	Technology	15 (93.75%)
2	People oriented	14 (87.50%)
3	Organizational	13 (81.25%)
4	Market	13 (81.25%)
5	Environment and regulations	12 (75.00%).

Table 14: Factors driving the digital transformation of IA companies

The above table 14 presents the elements driving the digital transformation in IA organizations, as revealed by the interview participants. The above table shows that the single most critical driving factor is technology. This is followed by people, organization, market, environmental, and regulatory aspects.

Technological Factors

Data analysis revealed that over 15 interviewees (93.75%) see technology as the primary motivator for the IA company's digital transformation. Professionals in the discussions observed that the main technological elements were disruptive new digital technologies like IoT, cloud, digital twins, and RPA. The discussion also focused on the aging legacy system and the need to replace it with flexible advanced systems; and IT-OT synergy (information technology and operation technology).

IA companies supplied the plant control system to automate the machines and processes. The main focus is converting the analog data to digital form and controlling the parameters for automating the operation. Control systems improved plant efficiency and made it less prone to human error, increasing productivity, quality, and safety. However, new technologies like IoT, cloud computing, edge computing, open automation form (OPAF), robotics, artificial intelligence, big data, machine learning, and deep learning are becoming essential in the digital era (Piccarozzi et al., 2018; Schaede, 2020; Brien, Resnick, and Avery, 2018; Ramnarayan and Mehta, 2020). Professionals interviewed by the researcher believe that consumer technologies and customers' digital experiences are raising industry clients' expectations; they want data-driven insight and detailed analysis to help them make quick decisions. The CEOs interviewed by the researcher appeared concerned, as technology is changing too quickly, and updating is critical. One of the vice presidents who was overseeing oil and gas customer relationships revealed, "You know IA companies are required to be one step ahead in technology innovation, plan automation is no longer control business, With the innovation of IoT, cloud, and artificial intelligence, both IT and

OT are converging. Many big IT industries are looking to enter our market, and if we are not transforming our business model and coming out with an IT-compatible system, we will be obsolete soon." The interviewee's voice was directed toward technological factors. New disruptive technologies are forcing all industry leaders, including IA firms, to quickly transform and adopt new digital tools.

People Oriented Factors

In this study, 87.50% of the participating professionals believe that people-oriented factors drive IA company's digital transformation initiatives. People may be the firm's employees, customers, and other stakeholders. The researcher's in-depth conversations with industry practitioners reveal; several people-related elements, like a young, digitally savvy, yet inexperienced workforce, increasing expectations of customers, and resource scarcity combined with a skill gap.

When the researcher interacted with the customer, he was very concerned about the workforce "In my plant, now our experienced operators and other technical staff started slowly retiring. We are increasingly recruiting new resources, and they are very young, talented, and digitally savvy, but hmmm… they are inexperienced and do not have plant exposure. Leadership is responsible for developing the digital documents and training materials, including video records, for preparing tomorrow’s workforce." He was looking towards IA companies to prepare completely digitalized automation, know-how, and training material. In addition, due to the emergence of new technologies, the expectations of customers are increasing. Now plant management team wants a compressed dashboard on their notebooks (Tabs) and mobile devices. To meet the requirements of the digital age requirements, IA companies must be innovative in developing systems for real-time data collection, analysis, and prediction to provide accurate insight into the equipment.

Even the expectations of the employees working at IA companies is changing. The young workforce is uninterested in repetitive assignments and looks for innovative tasks. After the Covid-19 impact, more employees are opting to work from home. Both employees and customers look for remote engineering and remote testing operations. All such requirements drive organizations to build digital infrastructure and remodel their firms to be digitally transformed.

Javadi (2022), in his article "7 pillars of Digital Transformation Framework for Continuous Business Growth," observe that an excellent reason for firms to implement digital transformation initiatives can be an opportunity to improve the customer experience. The organization can deliver more effective and efficient products and services with advanced and modern technologies. Such initiatives will help to increase customer satisfaction and, in turn, long-term relationships. In line with Javadi (2022), Verino and Titko (2019) also agree that customer requirements and their increasing needs are one of the main drivers for digital transformation. From the work of Javadi (2022); Verino and Titko (2019) it is evident that the customer is one of the key drivers along with employees and other stakeholders. The study by Ali (2019) indicates that employee empowerment is vital to transformation.

Organizational Factors

In this research study, 81.25% (13 participants) of professionals noted that several organizational-related factors are driving the digital transformation need for IA companies. Interviews and further content analysis revealed organizational factors like the need for productivity improvement, Covid-19 impact, the opportunity for new growth, and the necessity to look for new opportunities. Several business heads leading marketing, engineering, and customer relationship pointed out that process and manufacturing industries are under pressure due to fluctuating commodity prices and are forced to reduce their capital expenditure, significantly impacting IA companies. IA company's profit margin is reducing, and they need to develop digital tools and new technologies to increase productivity and reduce engineering, testing, and operational costs.

Covid-19 has thrown both opportunities and challenges to the IA world. Covid-19 necessitated IA companies to invest heavily in cloud infrastructure to facilitate engineering and customer validation remotely without requiring traveling to "on-premise" setup. The emergence of new technologies is creating new opportunities for IA firms. As a well-established provider of automation solutions, IA firms excel at sensors, which are critical for IoT (the Internet of Things). In addition, they have a ready solution for monitoring and control solutions like SCADA (supervisory control and data acquisition system) and PLCs (programmable logic controllers). To sustain growth and remain competent, IA companies are required to constantly look for new market opportunities. Smart factories, smart city projects, and pollution control (air and water) are new options where these firms can easily capture the market. Even though IA companies were the pioneers in control and automation, cloud, remote engineering, SaaS (software as a service), and PaaS (product as a service), many IT aspects were involved, and protecting the systems from cybersecurity threats was another big challenge. These factors are prompting leaders to invest heavily in digital transformation and implement it at scale. To understand the current status of the IA companies, one of the leaders recommended for SWOT (strength, weakness, opportunity, and threat analysis) analysis of the organization to understand the strengths and weaknesses of the firm. In his words, "I believe SWOT is a good tool to understand our own organization's strengths and weaknesses and from where we have threats. I often conduct the SWOT analysis before making any strategic decision."

Figure 36 depicts the SWOT analysis of IA firms pertaining to digital transformation based on data from the interviewer and a literature review. IA companies are pioneers in operations technology. As part of automation, these firms have a wide range of sensors and control systems, essential components of any process and manufacturing industry. Because of their sensor domain knowledge, IA companies have a good opportunity in medical devices, space devices, smart city projects, and other digitalization requirements. However, IA companies need to improve in consultancy practice, where renowned consultants like Mckinsey, Deloitte, KPMG, and Accenture dominate. Lack of information technology knowledge and resources is another notable weakness for IA firms; they must improve the

IT infrastructure at a large scale to successfully capture the digital transformation market. In terms of threat, open-source products that compete with legacy and traditional automation systems are now infiltrating the IA industry. Threats from data security and cybersecurity and competition from IT giants are other issues that IA companies must handle.

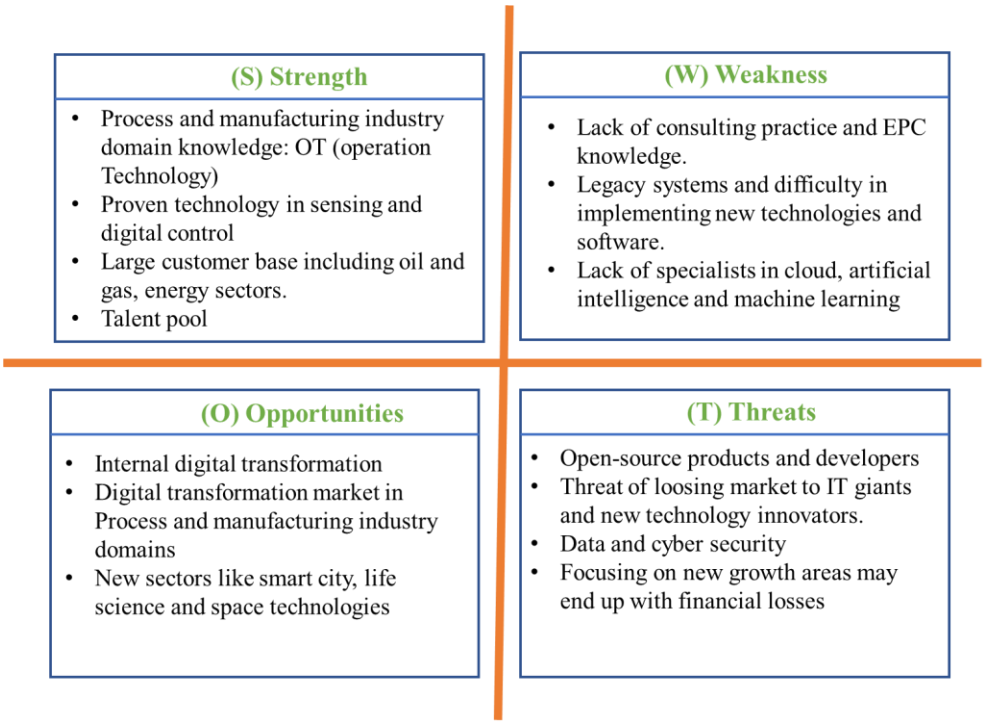

Figure 36: SWOT analysis of IA Companies (Own development)

Market Related Factors

In this study, 81.25% of the professionals (13 participants) note that market-related factors drive IA companies to implement digital transformation. In the interview, industry practitioners expressed that they fear losing their market share in the industrial automation sector if they do not adopt emerging digital technologies and transform internally. Internal organization transformation is insufficient, and two-fold transformation is the fundamental requirement. IA companies must rapidly innovate and develop an industry-enabled solution for the digital transformation of process and manufacturing companies.

Technology innovation and prototype testing have to be done in the rapid phase to avoid becoming digital prey. Eric Pearson, the CIO of the Intercontinental hotel group, once quoted, "It is no longer big beating small, but the fast beating the slow" (Yokogawa, 2021). This statement is self-explanatory about the current situation in the market. Echoing similar views, one of the project managers leading the cloud infrastructure project in his organization said, "Well, you know…days are gone where industries used to spend months and years on R&D (research and development). There is big competition in the market to bring out the solution and attract customers. To meet the demand, our firm has now adopted the agile project methodology. Nowadays, the software is tested and released incrementally so that customers can experience it and give feedback. This also aids industries in "early failure and early learning, as well as rapid success." In figure 36 above, the SWOT analysis complements the view on market drivers. The analysis shows that there is always a threat of losing the market to IT giants and new digital innovators. Research records from Verino and Titko (2019) and Yokogawa (2021) align with the interviews noted; both studies show that market elements like competition, fear of losing the market, and speed were the driving factors of digital transformation in any firm.

Environment and regulations

companies provide solution for water management systems in the cities and also sewage water treatment plant solutions. These companies for years have been supplying Co2, Oxygen, and other element-analyzing meters. Green energy, hydrogen plants, and battery manufacturing firms are equipped with a wide range of monitors, control, data gathering, and data analysis systems supplied by IA companies. Thus, these companies support their end users to meet environmental and regulatory requirements. Internally within the organization, IA firms are mulling toward the paperless operation and business model. All approval, including the expenses, is now digitally approved without printing the papers. Even factory acceptance tests (FAT) are being conducted paperless, which otherwise consumes hundreds of thousands of paper, ink, and markers. One of the team leaders leading the largest liquified natural gas (LNG) plant project proudly quoted, "Thanks to

covid-19, now we have moved to completely paperless internal FAT and FAT. All test documents are digitally reviewed, verified, and signed… I am proud that I would have saved at least 100K papers in the project…and so the carbon footprint". He further explained that due to covid-19, international customers could not travel, and all stakeholders, including customers, agreed to use cloud infrastructure to store project documents, which can be viewed, marked/highlighted, and finally, check sheets are signed digitally.

Manufacturers of chemicals, refineries, and pharmaceutical plants must adhere to increasing government safety and environmental policies. A data-driven strategy is required to enable operation, maintenance, and business personnel to take corrective steps quickly and easily during abnormal conditions. IA companies play a vital role by providing IIoT (industry internet of things), data analysis, and digital prediction tools, which help in the safety of the resource, safe operation, and the environment. In this regard, Yokogawa's (2021), study on driving factors revealed that digital technologies are set to transform the global energy system in the coming decades, making it more connected, reliable, and sustainable.

Summary of Factors that are driving Digital Transformation in IA Industries

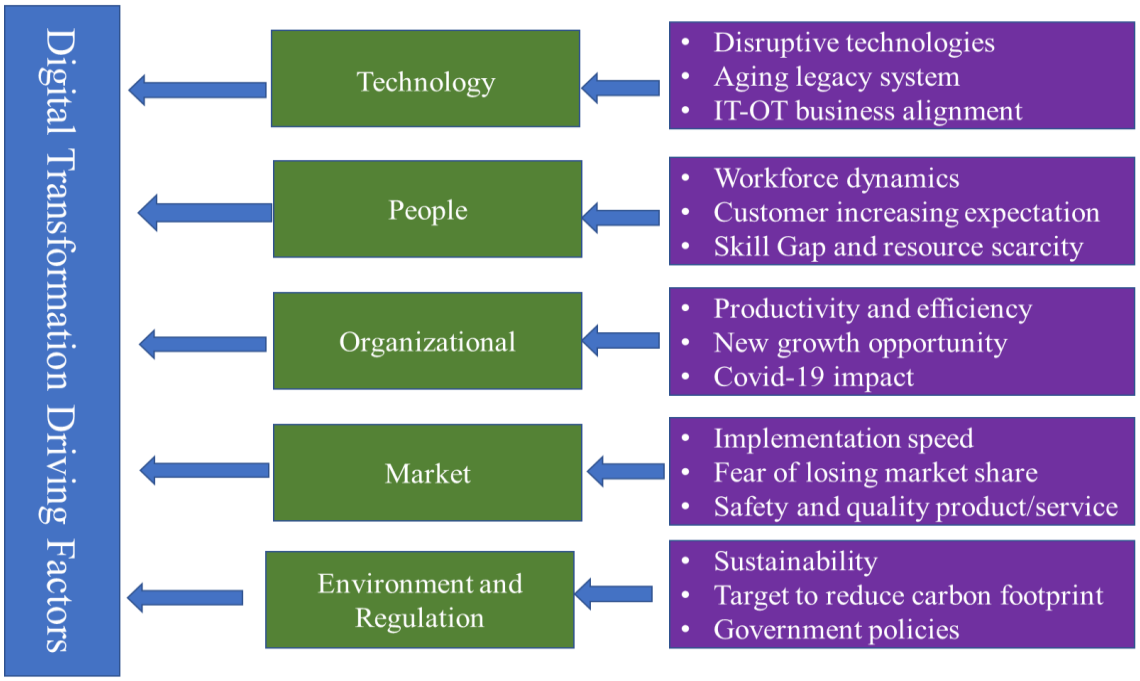

Figure 37: Driving Factors of IA Companies Digital Transformation

Most of the points noted by interviewees were in accordance with the literature review from section 3.5. Elements like disruptive technologies are similar to the findings of Verina and Titko (2019), Ali (2019), and Yokogawa (2021), whereas customer and employee-related factors were recorded by Javadi (2022) and Yokogawa (2021). In the digital transformation concept and framework survey, Verina and Titko (2019) observe that technologies are the most frequently mentioned element. Complementing this view, a study from Yokogawa (2021) reveals that the emergence of modern technology, like the cloud and big data, is the main reason organizations strive to transform their firms. According to Yokogawa's (2021) analysis, these technologies have opened up new opportunities for IA companies beyond traditional control businesses. Systems provided during industry 3.0 are old systems, and due to new technology, these systems require either significant modification or replacement. Increasing customer requirements emphasizes advanced and flexible systems that can provide real-time data (Yokogawa, 2021). Implementing technology in the IA industry is essential as many repetitive actions are performed in engineering, testing, human resources, accounting, finance, and the logistic process.

Robotic process automation (RPA) is a common software tool for optimizing business processes.

An in-depth discussion with practitioners like Covid-19, sustainability, and carbon foot printing reveals a few new insights. The summary of the research findings on driving factors is presented in figure 37. Overall, the researcher has captured the comprehensive driving factors pertaining to digital transformation initiatives in IA firms.

5.5 Results and Discussions on Action Fields

Section 5.4 provided a holistic framework of factors driving the digital transformation in IA organizations. After gathering clarity on the driving factor, the researcher wanted to establish the action fields that IA companies needed to focus on and implement the transformation initiatives.

In the research data collection, during the interview with professionals, to capture the action fields that need to be focused on for IA companies, a question was raised, i.e., What are the action fields in IA organizations that require transformation? as shown in figure 15, the study revealed the three major action fields that IA industry leaders to pay attention. These action fields are: 1. customer and supplier experience 2. employee experience 3. Organizational requirements and culture. Each action field has four action items to work on to achieve success. All these principal action fields are discussed in detail, and this explanation addresses the research question: What are the action fields in IA organizations that require transformation? Overall, this section addresses the objective of "identifying the areas required to transform."

SL NO	Action Fields	Total number of interviewees cited. (N=36)
1	Customer and supplier experience	15 (93.75%)
2	Employee experience	13 (81.25%)
3	Organizational requirements and culture	12 (75.00%)

Table 15: Action Fields for IA companies Digital Transformation

Customers and Suppliers Experience

In the study, 93.75% of the professionals (15 participants) emphasized focusing on customer and supplier experience-related action fields. Any industry transformation should be customer-centric and provide value to the customer experience. However, in the participant's opinion, the organization should give equal importance to the supplier. Four action items relevant to IA companies, customers, and suppliers were also noted. These action items are: 1. Database testing and validation 2. Remote verification infrastructure 3. Remote site support 4. Multichannel communication and collaboration tools. IA projects often involve many prototype tests, workshops, and factory acceptance tests (FAT). It will often be inconvenient for customers and suppliers, to travel (especially for international projects where, in an IA company, vendors/ suppliers, and customers will be at different geographical locations); hence, they prefer to conduct these activities remotely. To support such a requirement, IA companies should transform "on-premise" test methods to remote test and validation processes. In addition, IA project test validation involves a large volume of data and parameters, which consume several weeks or months for manual verification. Customers expect a digital tool to perform automatic validation and create reports. "Gone are the days when customers would travel for months to conduct FAT," said the engineering department head. "Nowadays, every company is looking for cost savings, so we need to develop our remote infrastructure, such as team/Zoom meetings and remote test systems." He also noted that now customers, during commissioning, prefer a minimum of IA engineers at the site, and most of the activities are remotely managed for cost optimization. For collaboration, tools like headwear, team, zoom, and Skype are widely used by IA companies, customers, and suppliers.

Employee Experience

In the study, 81.25% of the professionals (13 participants) noted that leaders should focus first on employee experience action fields to successfully implement digital

transformation. Conversation with professionals revealed four action items relevant to employees' action fields: 1. Hiring and onboarding experience 2. Settlements, payrolls, and online learning 3. Performance management experience 4. Digital tools for engineering, testing, and quality process automation.

Hiring, onboarding, and performance management experience require transforming the human resource department; employees should have a transparent and digitized system. Another action item was expenses, leave settlements, and pay role. Employees prefer not to waste time on settlements, and an automated and hassle-free process for leave approval will boost employee satisfaction and, as a result, productivity. Developing and applying digital tools for engineering, testing, and quality validation is critical and linked with customer satisfaction. The team leader managing engineering for the mega project noted, "My team is spending time on more repeated tasks…hmmm…less interesting…new Gen Z (born after 1996) workforce does not like to work that way. I am raising this concern in all management meetings and recommend that leaders invest in developing digital tools, robos, and bots". He was referring to robotic process automation (RPA), which reduces time and human errors. Bots are extensively used in IA firms for various operations, including database backup scheduling, software and patch installation on the workstations, and other repetitive tasks. IA companies should focus on investing and developing tools to truly transform their organization. There are several RPA tools available in the market. Figure 38 depicts some of the most popular tools. Each tool has merits and demerits, and analyzing the tool is outside the scope of this research.

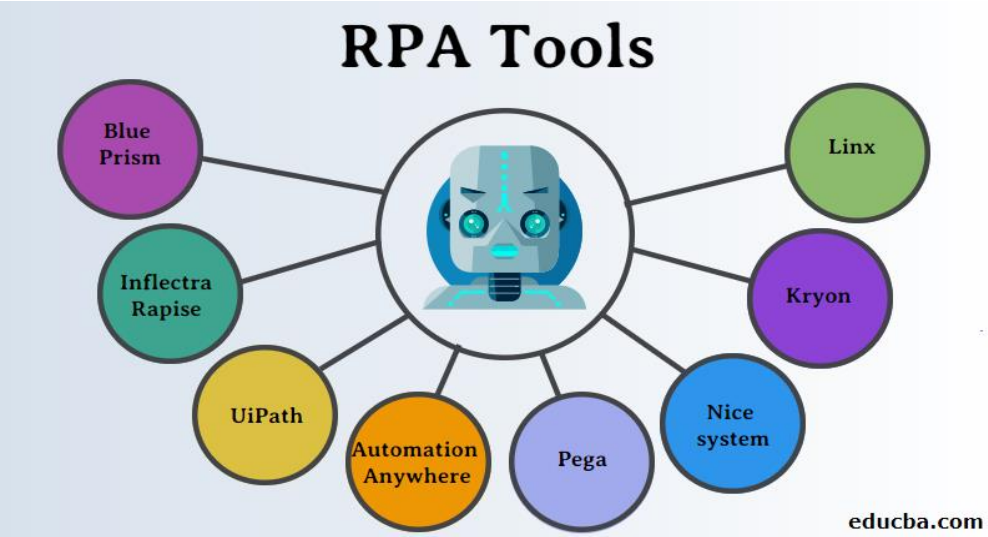

Figure 38: RPA Tools (educuba.com, 2022)

IA company leaders responsible for digital transformation should assess the RPA tools in the market and adopt the appropriate tool for their operation. IA companies sometimes even choose to develop in-house tools for their operations.

Organizational Requirement and Culture

In the study, 75.00% of professionals (12 participants) emphasized focusing on organization and culture-related action fields. Participant's insights revealed four action items that leaders must focus on; 1. Digitization of business unit operations 2. Develop agile and digital mindsets 3. Cross-function collaboration 4. Digital infrastructure development. Participants noted that more than just digitizing one or two units or departments would be needed, resulting in automation, not digital transformation. Organizations often try to digitize the marketing process, platforms, or ERP and fail to understand digital transformation. To gain the advantage, all organisational units, including accounting, finance, human resources, logistics, manufacturing, and engineering, must be transformed. As per Hofsted and Minkov (2010) organizational culture is the collective programming of the mind that distinguishes the members of one organization from others. Schlaefer et al. (2017) argue that organizational culture must allow innovation, creativity,

fail-learn, and agile cultures. Organizational leaders must train employees, enhance their digital skills, and develop a digital-first mindset. Cross-function collaboration is another action area that requires the utmost focus from leaders. The chief digital officer heading the digital transformation noted, " Main reason for digital transformation failure is not technology but siloed effort. "Unless we have cross-functional collaboration, we cannot succeed in our initiatives." Digital infrastructure development is a critical area that requires the organization's leaders' attention. Infrastructure requires colossal investment, and employees must be suitably trained to utilize the technology.

Summary of Action Fields

Most of the points noted by interviewees were in accordance with the literature review from section 3.6. Some of the action fields noted by interviewees are similar to the findings of Bumann and Peter (2019), and Gimplel et al., (2018), whereas both scholars did not note supplier experience. Employee experience is noted as a people field in Bumann and Peter (2019) research work.

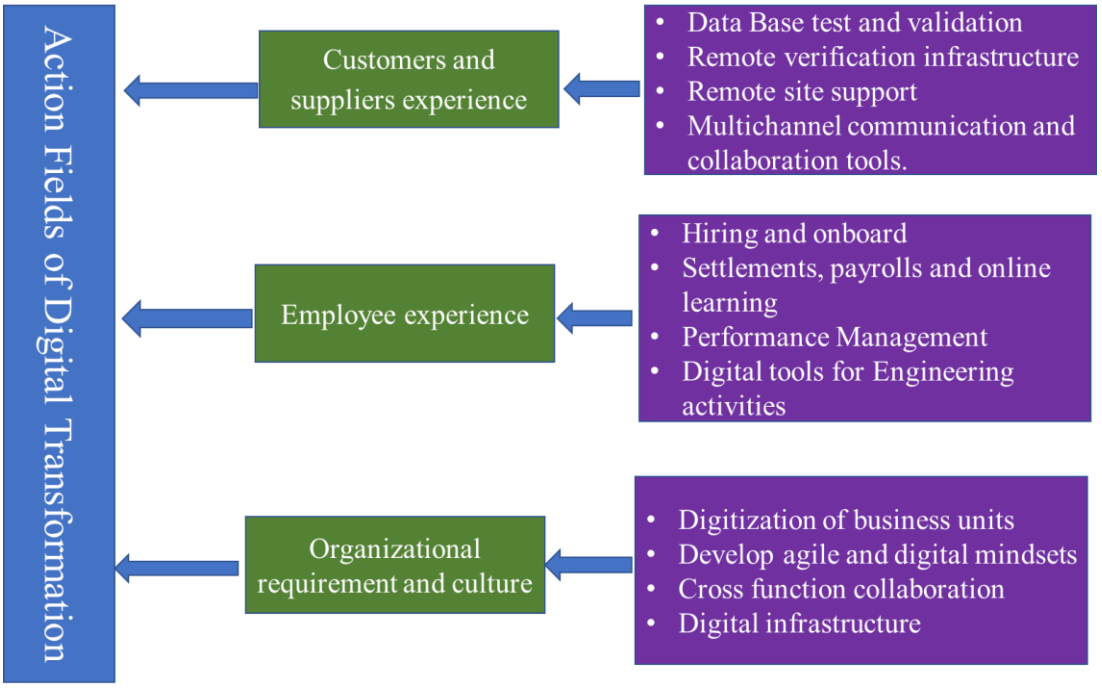

Figure 39: Action Fields of IA Companies Digital Transformation

Conversation with IA professionals reveals the action items specific to automation industries like database testing and validation, remote site support, and remote verification infrastructure. Action items like hiring and onboarding, performance management, collaboration tools, developing digital mindsets, and digital infrastructure, were noted by IA practitioners. A summary of the findings on action fields is exhibited in figure 39.

5.6 Results and Discussions on Digital Maturity Level

In section 3.7, the literature review provided the holistic framework to measure the digital maturity level. To understand the maturity assessment of the IA organizations, the researcher applied the method furnished by Raut (2020).

In the research data collection, during the interview with professionals, the researcher posted the question to understand the organization's maturity level, i.e., what is the current maturity level of IA companies?

The researcher presented the Raut (2020) maturity levels shown in table 16 and requested participants to select the appropriate option depending on their organization readiness. Results are illustrated in below chart 40.

SL NO	Maturity Level	Total number of interviewees cited. (N=36)
1	Minimal	0
2	Reactive	4 (25%)
3	Moderate	8 (50%)
4	Customer-driven	4 (25%)
5	Transformed	0

Table 16: Maturity Level Assessment

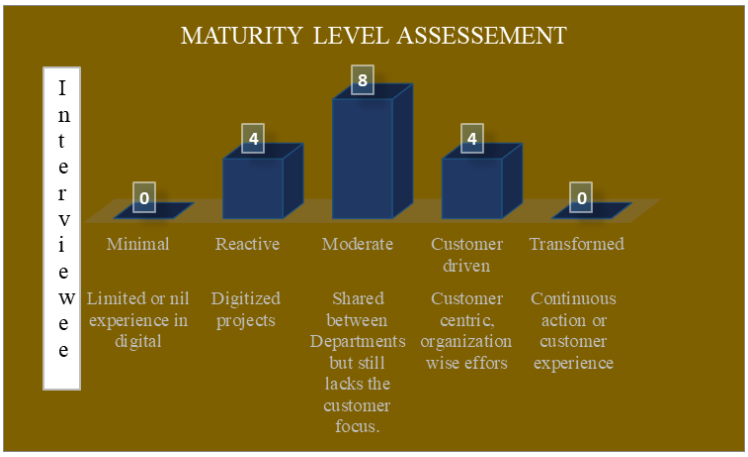

Figure 40: Maturity Level Assessment

When asked about their organization's digital readiness, the researcher received a varying response to the research study. While none declared that they were 100% transformed, and no one stated they had limited or no experience. In the words of one of the CEO who invested tremendous resources in digital transformation, “One thing I would like to make it clear is that there is no truly digital company, I mean 100% achieved. Specially IA companies have their own challenges… our digital strategy is driven by customer need and their willingness to invest… what I can say is we are moving in the right direction… achieved 70-80% success." Vice president of another company who was still low profile on transformation said “well we are already having a good market on traditional IA business; our customers are also happy with current technology. Even though we know the technology, we are moving in the slow phase…we may wait and watch the market trend ….another a few months or 1-2 years.. for full implementation”. It means all IA companies are aware of the digital transformation knowledge and technology; however, they have not yet achieved 100%. In the conversation, 50% (8 participants) of professionals consider their organization is moderate in the digital achievement level and shared between the departments but still lacks the customer focus; only 25% of professionals (4 participants) believe their organization transformation initiatives are customer driven. In the study, 25% of professionals (14 participants) noted that their organization is still reactive, with some departments digitized.

The researcher's objective was to assess the maturity level of IA companies. To summarize, organizations are at different stages of the digital maturity level, which depends on the vision of the top-level management, willingness to transform, employee skill sets, and investment in digital initiatives. After assessing the maturity, leaders must develop a strategic management plan (“how” part of the digital transformation) to achieve success.

5.7 Results and Discussions on Adopted Digital Technologies

Sections 2.5 and 2.6 provided an overview of technologies used in Industry 4.0 and digital transformation through an empirical study of the literature from various scholars and industry practitioners. Many digital technologies are available in the market, some requiring huge investments. As pointed out by scholars and professionals, technology should not be used just because it is available, and there are numerous lessons to be learned. In the past, industry leaders have washed the investment in adopting the technologies with limited success. Organizational leaders must assess their needs and select the best technologies for their businesses. IA industries must work on two-fold transformation, both internally and to enable the transformation journey of the customer. Hence, the technologies adopted by leadership impact both the organization and its customers. In the research data collection, during the interview with professionals, the researcher's objective was to investigate the critical digital technologies that IA companies adopted for digital transformation. The question was raised to the participants: "What critical digital technologies have IA companies adopted for digital transformation?". This section will shed light on the various digital technologies embraced by IA companies.

Table 17 and figure 41 show IA professionals' responses to technology adaptations. Most of the technologies and software are the same as those adopted by other industries or business domains. Robotic process automation (RPA), cybersecurity, IIOT, ERP, cloud, artificial intelligence (AI), and machine learning are common tools and technologies most organizations utilize. DCS/PLC/ SCADA and manufacturing execution systems (MES) are unique to IA companies. During the discussion, it was discovered that DCS, SCADA, and

PLC are essential to IA firms and are developed in-house. IA companies are either self-developing, partnering, or sometimes contracting other domain experts for other tools and technologies.

SL NO	Digital Technology Adopted/used for Customer DX	Total number of interviewees cited. (N=16)
1	DCS/SCADA/PLC	16 (100%)
2	Cybersecurity	16 (100%)
3	Robotic process automation (RPA)	15 (93.75%)
4	IIOT and sensors	15(93.75%)
5	Manufacturing execution system (MES)	14 (87.50%)
6	Digital twins	13 (81.25%)
7	ERP	12 (75.00%)
8	Cloud	12 (75.00%)
9	Artificial intelligence (AI)	10 (62.50%
10	Machine learning/deep learning	10 (62.50%)

Table 17: Digital Technologies used by IA Companies

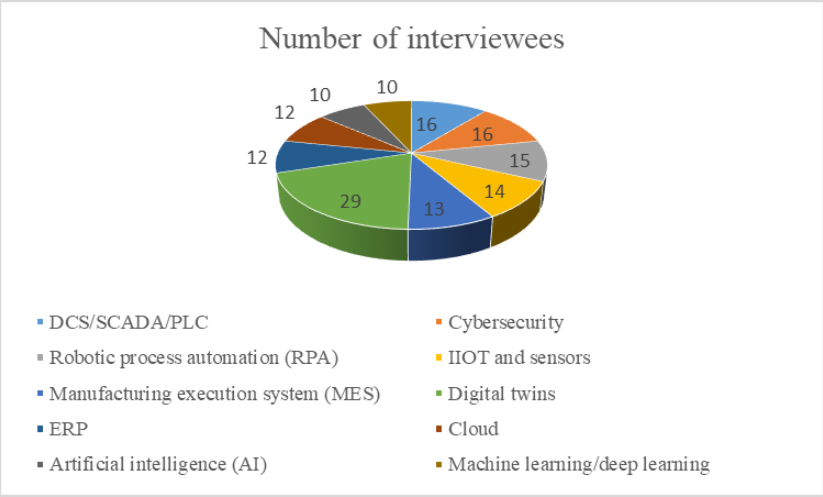

Figure 41: Digital Technologies used by IA Companies

DCS/PLC/SCADA:

Analysis of the interview with practitioners is listed in the above table 17. In the research 100% of professionals (all 16 participants) noted that they use distributed control systems (DCS), supervisory control and data acquisition systems (SCADA), or programmable logic controllers (PLCs), either one of them or all these systems (Yokogawa, 2021). All these systems are from industry 3.0, which digitized the plant operations. Control systems are used to enable automated plant operation to increase plant efficiency and productivity. However, it has to be noted that in many plants, these legacy control systems are becoming outdated, and it is required to modernize the technology. Traditional approach control systems are being challenged by open-process automation systems.

Cybersecurity

In the research study, 100% of professionals (all 16 participants) noted that cybersecurity is also their concern. They are driving towards taking full-fledged measures to take care of the cyber threat. For IA organizations, cybersecurity technology is essential for internal data security and the security of their customers in different manufacturing sectors. "Safety is paramount in the process industry, and as we open up our control system and become more flexible, there is much threat from external penetration to the plant and business network, and data theft, and our team is working hard to raise cybersecurity to the same level," said the company's vice president in charge of cybersecurity operations and management. Cybersecurity expertise is evolving to encompass the formerly disparate OT and IT domains. Network security with a firewall, antivirus software, regular patch updates, operating system patch updates, and user account management are some measures taken to ensure system security.

RPA

Another popular tool among industry automation professionals is robotic process automation (RPA) or bots. RPA is used for internal process efficiency and a smooth

customer experience during factory acceptance testing (FAT). In the research study, 93.75% of professionals (15 participants) said they had already used or planned to deploy RPA in their organization.

Robotic process automation (RPA) provides a virtual workforce to automatize manual, repetitive, and error-prone tasks (Klingeberg, 2018). Manufacturing industries, IA companies, and all business processes struggled to keep the back-office process fast and straightforward, mainly due to unskilled labor, and time-intensive and repetitive tasks. To overcome employee and customer pain points, RPA is widely applied (Parikh, 2020).

Overall usage of RPA is increasing year on year, and figure 42 illustrates the growth forecast till 2030. The RPA market is expected to grow to more than 13 billion dollars by 2030.

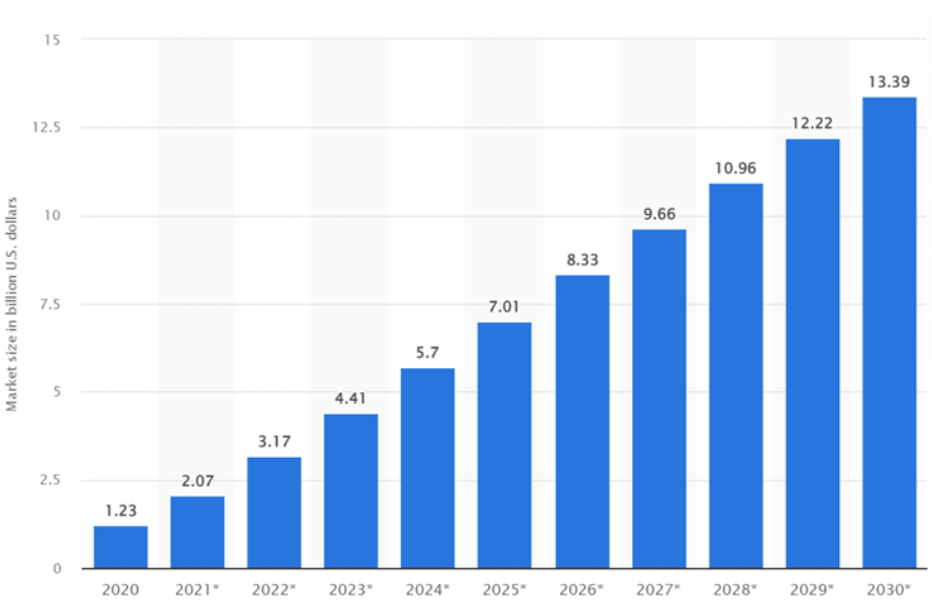

Figure 42: World RPA Market size (Statista, 2020)

The team leader handling engineering, testing, and validation explained: " Yea… with RPA, I could save a lot of time in engineering, repetitive verification check sheets, and

validation of repetitive tasks. My team can now focus on value-added functions". In IA firms, RPA is used in many applications, some of which are listed below:

1. Engineering activities like scheduled Database backups

2. Scheduled patch/software deployment

3. Prepare Testing and validation documents

3. Purchased order creation

4. Inventory management

To summarize, IA company professionals believed they could expect a 30% reduction in overall operating costs.

IIoT and Sensors

Industrial internet of things (IIoT) and IIoT-enabled sensors are another most used technology by IA firms; 93.75% of the professionals (15 participants) noted that they are adopting IIoT technology. With the help of IIoT, firms can grant remote access to machines to engineers, customers, and other stakeholders. As per Yokogawa (2021), the success of digital transformation depends on quality and reliable, measured data.

IIoT is used in below applications:

1. To track the expensive assets

2. Preventive maintenance of machines and equipment.

3. Remote monitoring and control of equipment

IA companies use IIoT and sensors to increase the customer experience.

MES

In the research study, 87.50% of the professionals (14 participants) conveyed that a manufacturing execution system (MES) is used to enable efficient plant operation. MES tracks the transformation of raw factory materials into end products during production and how physical property gets converted into dollars. Thanks to technological advancements, IIoT-enabled sensors can connect directly to MES, and MES can communicate directly with ERP (Yokogawa, 2021).

Digital Twins

In the research study, 81.25% of professionals (13 participants) said that digital twins are used by their organizations. The digital twin is the virtual replica of a real-world product, system, or plant that is continuously updated with data from its physical counterpart (Yokogawa, 2021). A digital twin is the digital version of a real-world component or process. One can design, commission, and simulate the operation in the virtual world using digital twins before building prototypes of the systems or equipment.

Application of the digital twins (Gao et al., 2019)

1. Plant-wide process monitoring: To detect abnormalities in the industrial process.

2. Equipment life prediction: The system uses IIOT, machine learning (ML), and artificial intelligence (AI). The lifetime data are often collected from the dedicatedly designed accelerated life test.

3. To train the operators: Replica of the plant and equipment are used to train the operator by simulating the operation.

4. Asset management: Powered by digital technology, abundant data and models from interconnected assets can be shared across the plant. The asset data for analysis can be collected in the physical and virtual spaces from various sources, such as the supervisory control and data acquisition (SCADA) systems and hardware-in-the-loop simulations.

Enterprise Resource Planning (ERP)

Enterprise resource planning (ERP) is used by IA companies for their internal transformation. ERP can also be part of a complete digital transformation package for the customer. ERP manages day-to-day business activities such as accounting, procurement, project management, risk management and compliance, and supply chain operations. The majority of the large and medium manufacturing and business units use ERP. IA companies do not have their ERP system; they usually buy from the service provider. While providing full-scope digital transformation solutions to the customer, they partner with ERP companies. For manufacturing and process industries, IA companies mainly furnish integration with ERP. In the interview, 75.00% of professionals (12 participants) stated that they use ERP. It was observed that large and medium firms were using ERP, whereas small companies do not like to invest.

Cloud Infrastructure

In the interview, 75.00% of professionals (12 participants) stated they were adopting cloud infrastructure. Cloud enables users to exploit virtualization and consolidate servers and workstations, with minimum investment and support to provide worldwide services. Many IA company applications are now suitable with cloud computing technology, such as asset management, sustainable energy apps, data historians, and predictive maintenance (Lata and Jayprakash, 2017). Below figure 43 shows how Yokogawa, one of the IA companies, uses the cloud infrastructure for its applications.

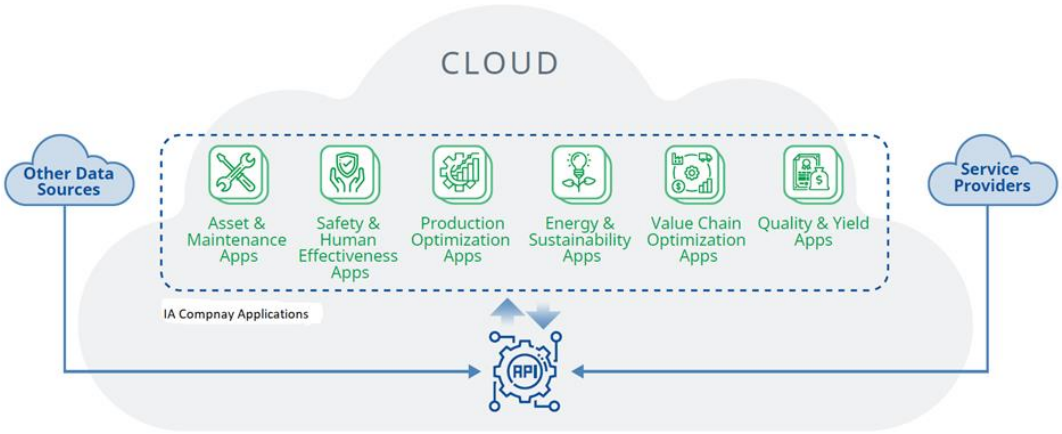

Figure 43: Cloud Infrastructure used by IA Companies (Yokogawa, 2021).

Cloud components typically include servers, storage devices, and storage. Companies can use cloud computing to focus on flexibility, on-demand, and pay-per-use. The CEO of the large IA company noted, "Cloud has brought an unprecedented change in how we operate. "By using the cloud, both suppliers and end-users can save on costs, and now we do not have to worry about maintenance like patches and antivirus updates, all we need is a laptop and a network, and now my staff can work from anywhere. "

Pertaining to industrial automation, the application of the cloud starts with engineering, testing, and diagnosis, as well as various other applications, as listed below (Lata and Jayprakash, 2017).

1. Remote engineering

2. Remote test and software validation

3. Remote site support

4. Data historian

5. Alarm Management

6. Asset management

7. Training simulator

8. Remote diagnosis

At the same time, professionals also noted that benefits are still weighted due to data privacy, cyber threats, and unknown server locations. However, the rise of cloud computing may be necessary for both IA companies and its customer, as the cloud imparts the means to maintain applications in a compact environment in a cost-effective approach.

Artificial Intelligence (AI), Machine learning and Deep learning

In the interview, 62.50% of professionals (10 participants) stated that they are using artificial intelligence (AI), machine learning (ML), and deep learning for both internal organization transformation and as an integrated solution to manufacturing, process, and other industrial customers.

Deep learning is a subset of machine learning, which is a subset of artificial intelligence. Artificial intelligence has seen enormous growth, and it is predicted to grow exponentially. Figure 44 shows the expected market size of artificial intelligence from 2021 to 2030. The market is expected to reach $1599 billion by 2030.

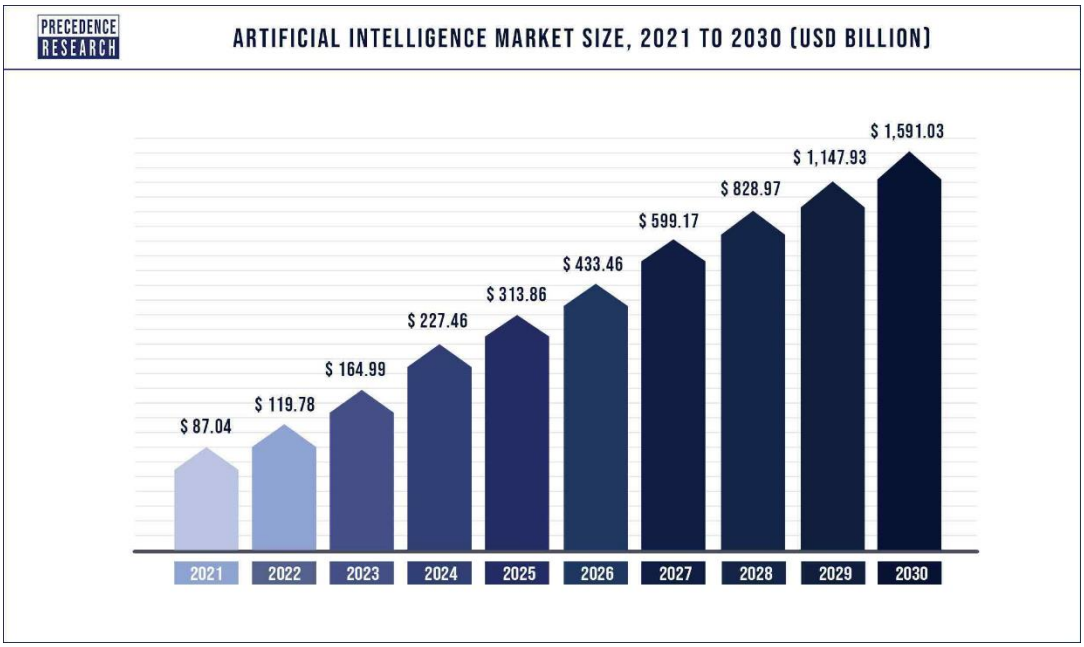

Figure 44: Artificial Intelligence Market Size (Precedence Research, 2020).

AI is used in industrial automation to handle the challenges like domain expert scarcity, complex decisions, overloaded information, and integration issues (Donepudi, 2018). The chief technical officer (CTO) heading digital transformation said," You know…Machine learning and artificial intelligence are game changers. In the manufacturing process, AI and

ML improve supply chain efficiency, detect fraud, and mitigate risks. The enormous amount of data can be turned into useful information using the right AI models."

Data and analytics are critical to the company's digitization and transformation efforts. Using AI, it is possible to visualize and interpret this large volume of data (Yokogawa, 2021). As per Kupper et al. (2018) analysis in the BCG report, AI can reduce producers' conversion costs by up to 20%, with up to 70% of the cost reduction resulting from higher workforce productivity.

There are many domains where IA companies can use AI, machine learning, and deep learning for both internal transformation and supporting the customer journey. AI is used in engineering to promote R&D efforts, improve response to customer demand, and effective production. AI models are deployed for equipment data analysis and predictive analysis for maintenance, which helps to increase lifecycle and unplanned breakdowns, resulting in improved production efficiency.

At the same time, using AI has many challenges. As pointed out by a CEO, one of the significant challenges is the server's computing power, which is expensive. Now, most organizations use the cloud instead of physical servers, which are affordable and available for on-demand usage. Another challenge is a trust deficit, as many people lack machine and deep learning knowledge and are unaware of the analysis report. Other challenges include skill gaps, data privacy, and security issues.

AI, machine learning, and deep learning are critical in the manufacturing and process industries and can be expanded to other firms. AI has become part of industrial automation, and its usage will increase further. IA professionals must develop skill sets, learn how AI works, and overcome AI implementation and development challenges with minimal risks and losses.

5.8 Results and Discussions on Critical Success Factors (CSFs)

Interviews with industry experts and transcript analysis provided enriched information on driving factors, fields that must be acted upon, digital maturity, and technology usage, as detailed in sections 5.4 to 5.7. To formulate a digital transformation strategy and management plan, it is essential to understand the critical factors that leaders need to consider while implementing. Section 2.8 provided a holistic view of lessons learned from previous failures and success factors.

Considering success factors as a critical element in the transformation, the researcher adopted a triangulation approach. At first qualitative analysis was conducted, and from the insights of the discussion, a questionnaire was formed for the survey. Using the survey response data, quantitative analysis was performed. This method utilizes the benefits of both quantitative and qualitative methods (Creswell, 1994; Greene, Caracelli, and Graham, 1989).

5.8.1 Qualitative Analysis:

In the research data collection, during the interview with professionals, to identify the critical success factors (Objective) that need to be considered for successful implementation, the question was raised, i.e. what makes a successful digital transformation? In other words, what are the success factors of digital transformation for IA companies? The study revealed the four major success factors that IA industry leaders to consider. These factors are: 1. strategy; 2. people; 3. process; and 4. technology. All these factors are discussed in detail, and this explanation addresses the research question: what are the success factors of digital transformation for IA companies? This section addresses the objective of "identifying the critical success factors."

Below table 18, present the success factors revealed by the interview participants. The table below shows that the single most critical success factor is strategy. People, organizations, and technology follow this.

SL NO	Success Factors	Total number of interviewees cited. (N=16)
1	Strategy	15 (93.75%)
2	People	14 (87.50%)
3	Organization	13 (81.25%)
4	Technology	13 (81.25%)

Table 18: Success Factors for Digital Transformation Implementation

Strategy:

Analysis of the data showed that more than 15 professionals (93.75 percent of those interviewed) think that strategy is the most critical success factor for digital transformation.

Professionals say that making a strategic plan for digital transformation is the most important thing to do first. Digital transformation should be strategic because it needs to be aligned with corporate business goals and objectives. The chief digital officer (CDO) appointed for transforming the organization said, " One of the first things I would do is to have a brainstorming meeting with management to understand their organization goals, what they want to achieve through the digital transformation, and the current status of the organization. For me, transformation should be customer centric, I will analyze what customer and stakeholder pain points we are addressing through this transformation; unless our efforts bring value to the customer, the transformation has no meaning". Echoing similar views, other industry practitioners agreed that strategy formulation is essential. However, at the same time, they highlighted that no comprehensive management plan could be used and acted upon. The project manager who was overseeing the implementation of the transformation project was skeptical about its success. He observed:

"for other projects, we have PMI or Prince or other frameworks that are guiding for the execution, digital transformation projects are complex and require a comprehensive transformation management plan". The vice president heading ERP implementation was concerned with the schedule and budget. He said, "I understand the importance of digital transformation implementation, but it impacted other activities. Digital initiatives must be monitored and governed, probably by the project management team." The vice president and other professionals resonated with the need for a comprehensive strategic management plan to scrutinize the implementation progress, control cost, and schedule, and more importantly, align with customer satisfaction (Value to customer), and organization goals, as illustrated below in figure 45.

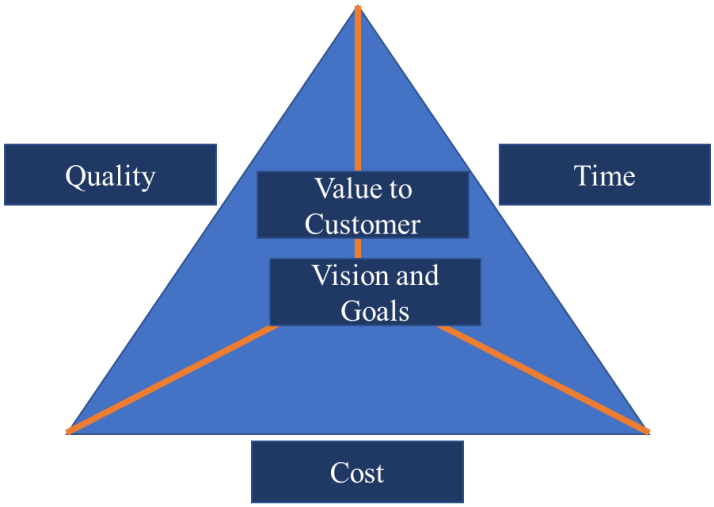

Figure 45: Key Performance Index for Success of the Digital Transformation

Hence, it is vital that the governing team monitors and controls digital transformation initiatives. Phase gate review, also known as "go-no-go" in traditional project management (TPM), brings visibility of the project progress to all the project-impacted stakeholders. In the waterfall method phase, gates define scope, review and clarification, development of product/service, testing and validation, and deployment. However, in agile, the approach is slightly different. Phase gate review is realized through frequent builds of the product, iteration, and ongoing regression testing. These phase gates are called "agile stage gate"

reviews in the agile approach. Conducting either a phase gate review (waterfall) or a "stage gate review" in agile will help to review progress, get feedback, and apply to improve (Byrne, 2020).

Findings from interviews were in line with the literature review; strategic management was identified as one of the critical success factors (Westerman et al., 2011; Jacobi and Burner, 2017; Bumann and Peter, 2019; Deloitte, 2015; Mckinsey, 2018; BCG, 2021; Yokogawa, 2021; and Digital Cxo, 2021). Scholars, consultants, and practitioners all revealed the importance of strategic management. In the view of industry practitioners, most of the consultant framework addresses the strategy design phase, but coverage with respect to execution, monitoring, and control is limited.

People:

Data analysis revealed that more than 14 professionals (87.50% of interviewees) regard people as the success factor that will result in a successful digital transformation implementation. People's definition refers to customers, employees, suppliers, and leaders.

The vice president of the human resources department said, "It is people who make the difference. People need to understand the need for "why": why we need to embrace digital transformation. It is critical to communicate with employees regarding organization initiatives." Another department head stressed communication and engagement. He noted, "If we cannot articulate what we are transforming into, and why, or how it benefits customers, employees, or other stakeholders, then why do they show interest? Moreover, keeping them engaged with the status of the transformation is critical to getting their cooperation". He also emphasized obtaining customer feedback regularly and executing necessary actions. At the same time, another chief digital officer argued that "Collaboration between different departments is the most important factor. Most of the departments work in silos, which end in failure." Practitioners emphasized equipping resources with the necessary skills and infrastructure; according to him, micromanagement is not required;

the role of leaders is to analyze skill and infrastructure gaps and ensure team requirements are met so that the team can perform better.

The project management team uses a stakeholder template to identify the critical stakeholders, keep them engaged, and meet expectations, as shown in figure 46. A stakeholder template is a critical tool for any project or business owner to identify the key stakeholders they must interact with and engage.

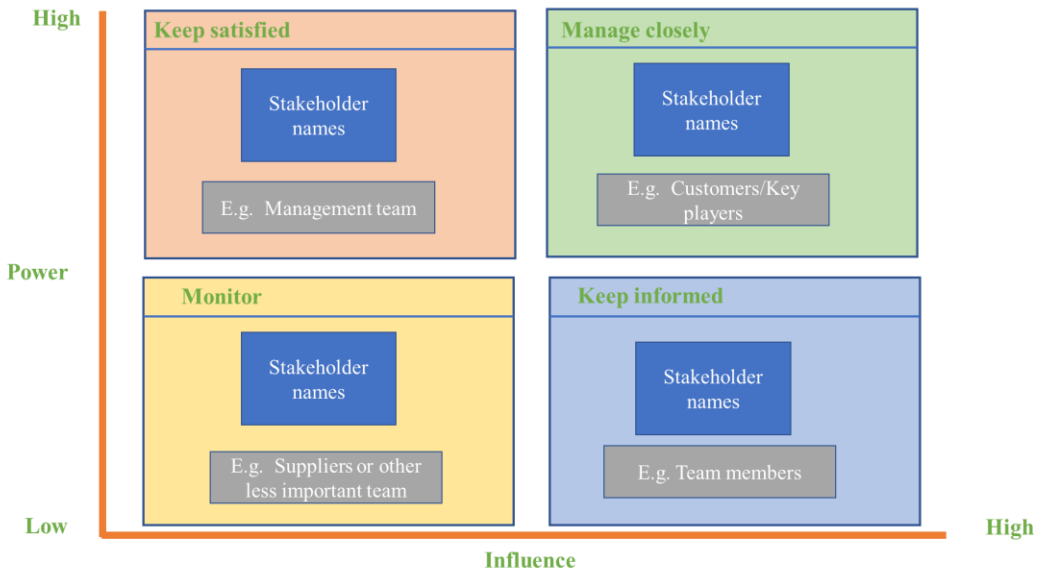

Figure 46: Stakeholder engagement chart

Stakeholders can be internal or external. After identifying, it is required to rank them. Customers are the leading players; engaging them with necessary information is critical to success. The management team will not influence the team, but they have high authority, keeping them satisfied. Team members do not have authority but are critical to success and engage the team with project updates. Other departments and vendors have the least influence and will not have authority, but the project team must still monitor their expectations.

In the literature review, Jacobi and Brenner (2017) noted that collaboration and stakeholder engagement are critical success factors. Bumann and Peter (2019) echoed similar views

about collaboration and customer experience. Bumann and Peter (2019) noted strong leadership, but practitioners emphasized employee empowerment and transformational leadership in the researcher interview. The transformational leader is digitally savvy and an encourager of innovation. Mckinsey (2018) observed that communication, collaboration, digitally savvy leaders, and a capable workforce are essential for execution. Yokogawa (2021) noted that breaking silos and leadership involvement were the critical success factors.

Organization:

Data analysis revealed that over 13 professionals (81.25% of interviewees) regarded organizational aspects as a success factor.

Practitioners during the interview touched upon a wide range of organizations elements. Practitioners recommended an agile and open work environment and stressed developing digital mindsets. The discussion also emphasised the importance of clearly defined critical performance indices and measuring methods, particularly an employee reward and performance appraisal system.

Digital transformation projects are expensive and complicated. Instead of the traditional waterfall method, practitioners recommend using agile and hybrid project management with open work culture. Leybourne (2009), described that the agile method consists of a mix of waterfall principles with flexible, lightweight, collaborative, and adaptive procedures suitable for frequent changes. In the literature review, Standish's (2020) survey also found that the agile project success rate is better than the traditional project management method.

In the words of the firm's CEO, "It is all about transforming mindsets because we have been doing things in a particular manner, and suddenly, we are asked to do it differently. That is mindset transformation.". As per the CEO, team members must have an open-minded attitude towards technology and change and be endowed with soft skills. The

thoughts of the CEO echoed those of Bowersox et al. (2005), who emphasized the importance of focusing digital mindsets on shaping organizational standards. During the interview question regarding the action fields, professional insight revealed that developing a digital and agile mindset is one of the vital areas that leaders need to focus on.

Key performance indicators (KPIs) and measuring methods were other vital element revealed during the conversation. Participants noted that leaders should have a list of KPIs that can be used to measure the output of transformation efforts. KPIs were the same as those discussed in strategic success factors, figure 45.

During the interview, another vital factor was noted regarding the rewards, recognition, and performance appraisal systems. The vice president of the human resources department voiced, " It is important to introduce monetary as well as non-monetary rewards and develop the performance appraisal system to encourage digital transformation."

In the literature review, chapters two and three, digital mindset, agile work culture, a digitally capable workforce, and an agile organization were reviewed as the success elements (BCG, 2020; Mckinsey, 2018; Gimpel et al., 2018; Bumann and Peter, 2019). Key performance indicators (KPI), rewards, and appraisal systems are the other two vital factors revealed in the discussion.

Technology:

Data analysis revealed that more than 13 professionals (81.25% of interviewees) regard technological aspects as a critical element in successful digital transformation.

During the discussion on action fields of employee experience and adaptation of digital technology, practitioners discussed in depth different tools and digital software used in the organization's transformation journey. Continuing the discussion, professionals agreed that these technologies are vital in successfully implementing digital initiatives. Even though strategy and people were a high priority on the list, professional agrees that technology is

critical for the success of the digital transformation. One of the engineering department heads noted, “Pandemic has accelerated digital transformation. A few years back, I still remember customers wanting to meet the salespeople, engineering people, and service people all face to face, whether in kick-off meetings (KOM), gate review meetings, or even for small discussions. Today they come back and say let's do a virtual meeting; let us connect via the team or use zoom.”

During the interview, several tools and technologies were highlighted by professionals, the majority of the tools and technologies mentioned by professionals are already discussed in section 5.7 and table 17. In addition, professionals noted some of the project management tools and techniques. Traditional project management uses Microsoft Project or Primavera. In an agile context, the time dimension of the project is relatively straightforward: defined as iterations (very often time-boxed). The critical feature required is to manage backlog items. This is more efficiently done with Jira, Trello, and similar tools. Moreover, these also cope better with story points, which would be very challenging for project schedulers. Now MSP and Primavera have also developed software compatible with the agile method. In addition, for agile project scheduling, which is usually a 1-3-week iterative process (also called as sprint), software tools like Jira, and Trello are used. Data digitalization and paperless communication were noted as success factors by professionals. Data digitization helps firms consolidate all data digitally, which helps maintain and store it. Paperless communication and work processes not only aid in data digitization and carbon footprint reduction but also improve efficiency. In addition to tools and software, professionals also emphasized building robust data privacy, data security, and cybersecurity systems so that the data generated is protected and people have faith in the technology.

The application of technology is primarily determined by the industry and organization. Success in implementation depends on the organization's approach towards using new technologies. Leaders must exploit emerging technologies and be ready to take risks (Hess et al., 2016; Ismail, Khater, and Zaki, 2017).

Summary of Success factors (Qualitative Analysis)

To summarize, the majority of the success factors noted by interviewees were in accordance with the literature review from section 2.8. The majority of the leaders noted strategy, strategy formation, strategy management, and aligning strategy with organizational goals and objectives as the main success factors, which was echoed in the literature review of scholars Westerman et al. (2011), Jacobi and Bernner (2017), Bumann and Peter (2019). Strategy was noted as the main factor even by consultants like Deloitte (2015), Mckinsey (2018), BCG (2020), and IA companies like Yokogawa (2021). People were identified as the most influential factor by all scholars, consultants, and IA firms, followed by process and organizational aspects. Technology was noted as one of the vital factors, and practitioners, scholars, and consultants were cautious about using the technology. The majority felt that digital transformation depends on a good strategy with the right combination of people, organization, and technology. A summary of the qualitative analysis of the success factor is shown in below table 19.

Digital Transformation Success Factors	
Strategy	• Strategic Management Plan, aligned with vision, goals and objectives • Strategy has buy-in from all stakeholders and driven by CEO • Digital initiatives are monitored and governed • Digital transformation address the stakeholder/customer pain points
People	• Collaboration and engagement with customer and all stake holders • Employee empowerment • Digitally savvy and transformational leadership • Customer and stakeholder needs are monitored and addressed
Organizational	• Agile and open working environment • Digital mindsets • Key performance index and its measurement • Rewards, recognition and performance appraisal system
Technology	• RPA and Bots are used in both internal and external transformation • Data digitalization and paperless communication • Data privacy, security and cyber security • Use of technologies like but not limited to, cloud, IIOT, AI, ML, Zoom, Team Video conference, virtual connections etc.

Table 19: Success Factors for Digital Transformation qualitative findings

5.8.2 From Qualitative to Quantitative Study

Discussions with the top management team provided insight into the data concerning success factors. However, it is essential to quantify the data considering the importance of the success factors. Quantitative research on the qualitative results will provide a more holistic view of the research subject matter that one has selected.

Qualitative research helped the researcher in building the quantitative research questionaries. It helped to get insight into industrial automation professionals' thoughts regarding critical success factors pertaining to IA companies. The researcher tested the hypothesis using quantitative analysis. Then, with the triangulation result of the literature review, qualitative and quantitative results will be used to recommend the success factors for digital transformation implementation.

5.8.3 Quantitative Analysis:

The success of digital transformation depends on various factors like strategy, people, organization, and technology. Digital transformation, particularly in IA companies, is still an evolving subject matter; hence, it is difficult to say that any single framework will provide all the inputs, knowledge areas, and practices for successfully executing the initiatives. The researcher has formed the questions based on the discussion points interviewed in the qualitative analysis.

Research Questionnaire Design

After reviewing the literature review and having an insightful discussion with IA professionals, the researcher designed the set of questionnaires using the Likert scale (Kothari, 2008). The researcher surveyed using Google forms, and the questionnaire format consisted of three parts:

1. The first section covers the basic demographic information: employee name, employee education, age, gender, designation, organization name, and organization size.
2. The second section covered the questionnaires on criteria to measure success (3 success criteria).
3. The third section was about the questionnaires on the success factors for the digital transformation project. The questions were ranked from strongly disagree to strongly agree; figure 47 depicts each element scale.

SL No	Element	Element Scale
1	Strongly disagree	1
2	Disagree	2
3	Tending to Agree	3
4	Agree	4
5	Strongly Agree	5

Figure 47: Questionnaire Ranking

Quantitative Data Analysis

In the quantitative method, the researcher has collected the primary data through a survey approach. The Pearson coefficient test identifies and validates the correlation between independent factors (strategies, people, organization, and critical technological factors) and dependent factors (digital transformation success). The collected data is then analyzed further by running a regression test with SPSS software. Findings from the survey and analysis are documented in the later part to establish the relationship between independent (success factors) and dependent (digital transformation success) variables.

Pearson Correlation Coefficient Test and Correlation Analysis

The complete definition is Pearson Product Moment Correlation or PPMC. It is used to prove the linear relationship between two sets of data. A correlation value is expected between -1 and +1 that exhibits the relationship's continuation, direction, and strength

(Obilor and Amadi, 2018). This relationship is demonstrated in below table 20. Values near zero indicate that the relationship is not strong or viable.

Coefficient	Strength Of Relationship
±0.81 to ±1	Very strong
±0.61 to ±0.8	Strong
±0.41 to ±0.6	Moderate
±0.21 to ±0.4	Weak
0 to ±0.2	Very weak or no relationship

Source: Ward, Winzar, Lowe, & Babin (2010)

Table 20: Success Factors for Digital Transformation qualitative findings

The correlation formula can be stated as below (Schober et al. 2018).

$$r_{xy} = \frac{\sum x_i y_i - n\overline{xy}}{(n-1)s_x s_y} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}$$

i value between 1 to n
X and Y are variables
Sx and sy are the sample standard deviations

These correlation results validate the relationship between strategy, people, organization, and technology (SPOT) factors and digital transformation success.

Regression Test

This test is a statistical process used to identify the data integrity of the selected data variables. Based on the independent variable data analysis, this method predicts the dependent variable value (Lowe et al., 2006). The regression formula is stated below.

$$Y = \alpha + \beta X$$

Y: Dependent variable X: Independent variable

The multiple regression formula is as below

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + \beta_n X_n$$

Data Validity and Reliability

Data validity assesses the suitability and accuracy of the survey results conducted by the researcher (Sekaran, 2010). The researcher has established the validity of the data through a correlation coefficient using SPSS software. The researcher used Cronbach's alpha to ascertain the data's reliability. Cronbach's alpha is applied to evaluate the data's stability, integrity, and consistency (Morgan, Leech, Gloeckner, and Barret, 2011), and the researcher has utilized SPSS and Excel for the same. Alpha greater than 0.7 is considered good; alpha greater than 0.6 is considered acceptable; and alpha less than 0.6 is considered less reliable (Morgan et al., 2011). As a result, for the data to be more reliable, it should be greater than 0.7 and closer to 1.0.

Research Hypothesis

Section 1.4 details the objective of the hypothesis, which is to understand the relationship between critical success factors (CFSs) and the success of digital transformation for IA companies. The hypothesis is as below:

H0: Critical success factors have no relationship with IA companies' digital transformation success.

H1: Critical success factors have a significant relationship with IA companies' digital transformation success.

From the references of the literature review and qualitative analysis, sub-hypotheses are formulated. Hypotheses form the basis for the importance of strategy, people, organization, and technology in industrial automation firms and the development of the SPOT framework. Researchers use hypothesis outcomes to identify the results that do not agree with the null hypothesis (Saunders, Lewis, & Thornhill, 2009). Below is the hypothesis formed for identifying the relationship between success factors and the success of transformation initiatives in IA companies.

Null Hypothesis-1:
H01: Strategic management has no relationship with digital transformation success.

Alternative Hypothesis-1:
H11: Strategic management has a significant relationship with digital transformation success.

Null Hypothesis-2:
H02: People factors have no relationship with digital transformation success.

Alternative Hypothesis-2:
H12: People factors have a significant relationship with digital transformation success.

Null Hypothesis-3:
H03: Organization factors have no relationship with digital transformation success.

Alternative Hypothesis-3:
H13: Organizational factors have a significant relationship with digital transformation success.

Null Hypothesis-4:
H04: Technology factors have no relationship with digital transformation success.

Alternative Hypothesis-4:
H14: Technology factors have a significant relationship with digital transformation success.

Quantitative Data Collection:

Several methods are available for quantitatively collecting and analyzing the research data, which are expensive and time-consuming (Creswell, 2013).

For this research, data was collected by using a survey strategy. The survey is a popular method among researchers and cost-effectively allows data collection.

Data was collected from CEOs, managers/senior managers, project directors/vice presidents, team leads, individual contributors, and other senior professionals. The

researcher used Google Forms, and all responses were taken as a separate source of individual data from each participant.

The survey is done only for the questionnaires, and beyond that, the researcher has not disturbed any professionals who contributed in the survey. Also, the time horizon was followed, and just once, only data was collected.

Based on our literature review and qualitative analysis theoretical framework can be derived, as shown in the below figure 48.

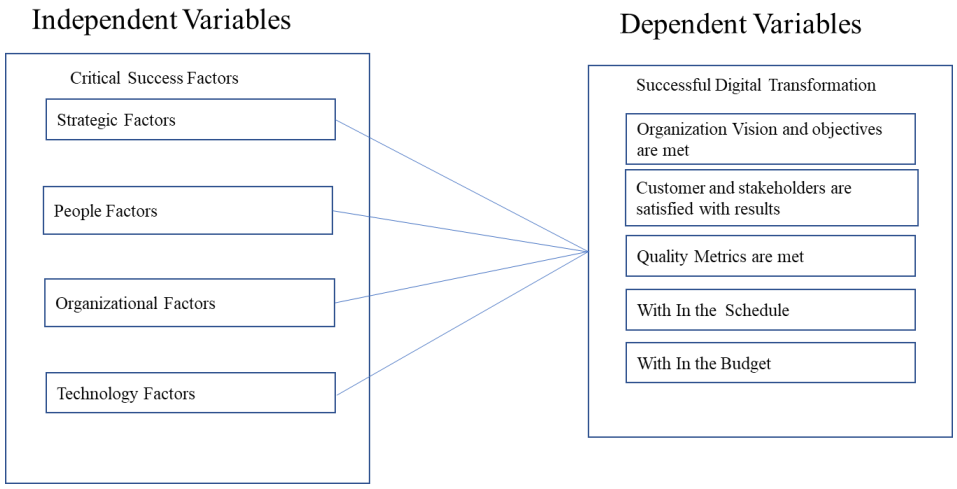

Figure 48: Conceptual framework for Success Factors

Detailed factors and questionnaires of individual strategy, people, and organization technology/tools (SPOT) are explained in Appendix-02.

Survey Findings:

The researcher got information from 120 professionals in India and other countries who worked for IA companies. However, some information was missing. The researcher narrowed the data to 101 professional responses. The digital transformation success criteria and SPOT factors were ranked from strongly disagreeing to strongly agreeing on the element scale of 1 to 5, as explained in figure 47.

Sample Profile:

Sample profile data was verified to see if sufficient data was collected from considerably diversified respondents.

Age	Participants	Percentage
Below 30	29	28.71
30-40	27	26.73
40 to 50	29	28.71
Above 50	16	15.84

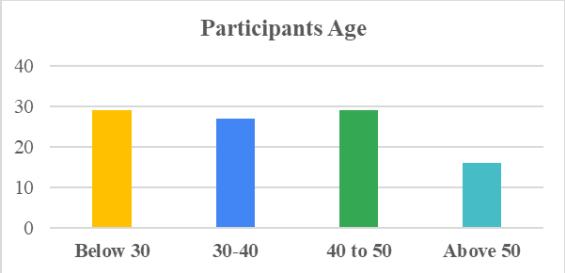

Table 21: Sample Profile by Age

Table 21 shows the responses by the age of the participants. The researcher received more responses from those below 30, who are expected to have 5-6 years of experience, and from the age group of 40-50, who are expected to have 18-30 years of experience. Next is the age group of 30 to 40, and then participants over 50. The sample consists of considerable diversity, and the data collected is representative of the population.

Education Level	Participants	Percentage
Graduation	27	26.73
Graduation with DX Certificate	29	28.71
Post Graduation and above	45	44.55

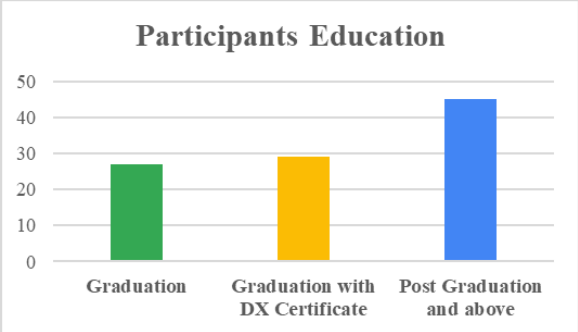

Table 22: Sample Profile by Education

Table 22 shows the responses by education of the participants. The researcher received more responses from post-graduation and above. Next is the graduation with a project management certificate closely followed by graduated members.

Role	Participants	Percentage
Individual contributor	25	24.75
Team Lead	28	27.72
BU Heads/Sr Manager	31	30.69
Directors and above	17	16.83

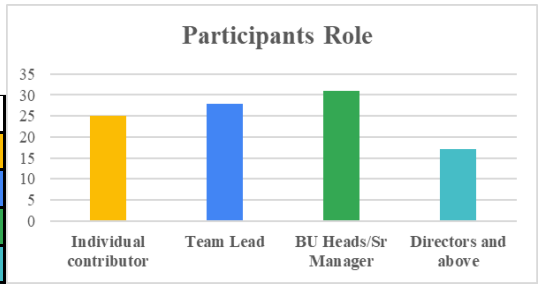

Table 23: Sample Profile by role.

Table 23 shows the responses from IA company participant's roles. Most respondents were business unit (BU) heads or senior managers. Followed by managers, the researcher had team leads and individual contributors. The sample showed a reasonably good mix of roles in a typical initiative like digital transformation.

Reliability of the Field Data:

Cronbach's alpha is calculated to validate the overall data and data by factors (Including strategy, people, organization, and technology have good internal consistency). The reliability of the entire set of data is given in table 24.

Cronbach's Alpha	No of Items
0.960	12

Table 24: Cronbach's Alpha for Field Data

Group	Cronbach's Alpha
Strategy	0.791
People	0.784
Organization	0.765
Technology	0.768

Table 25: Cronbach's Alpha Group Wise

Table 25 presents Cronbach's Alpha group-wise. Cronbach's Alpha was found to be greater than 0.60 for all the groups. The table demonstrates good internal consistency of the final data collection and shows data ready for further analysis.

Hypothesis Testing:

In the below section, hypothesis one (strategy), hypothesis two (people), hypothesis there (organization), and hypothesis four (technology) are tested.

Analysis of the Findings of Strategic Factors (CSFS):

The strategic factor scale stands at 4.40, proving that professionals have accepted this as a critical influencing factor for the success of digital transformation. The chart and data analysis shown in table 26 reveal that 46.44% strongly agree, 43.05% agree, and 6.44% tend to agree that if this factor is implemented, then the digital transformation success rate will be higher. The analysis also shows that 2.71% of the professionals opposed the strategic factor concept, and 1.36% of participants vehemently opposed strategy as an influencing factor in the success of the digital transformation.

Scale	Category	Response	Percentage
1	SD	4	1.36
2	D	8	2.71
3	TA	19	6.44
4	A	127	43.05
5	SA	137	46.44

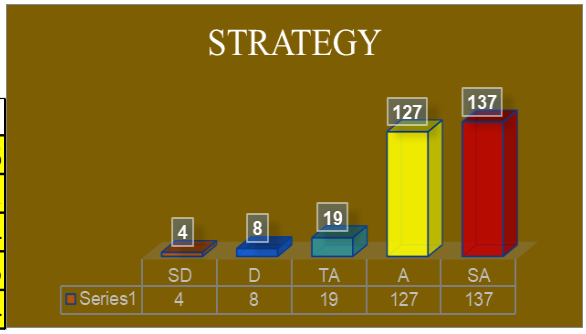

Table 26: Data Table (Strategic Factors: CSFS)

Analysis of the Findings of People Factors (CSFP):

The people factor scale stands at 4.36, proving that professionals have accepted this as a critical influencing factor for digital transformation success. Chart and data analysis shown in table 27 reveals that 46.78% strongly agree and 40.68% agree that the digital transformation success rate will be higher if people factors are implemented. The analysis also shows that 8.47% tended to accept the concept, and 2.71 % and 1.36% of the professionals opposed or strongly opposed the people factor.

Scale	Category	Response	Percentage
1	SD	4	1.36
2	D	8	2.71
3	TA	25	8.47
4	A	120	40.68
5	SA	138	46.78

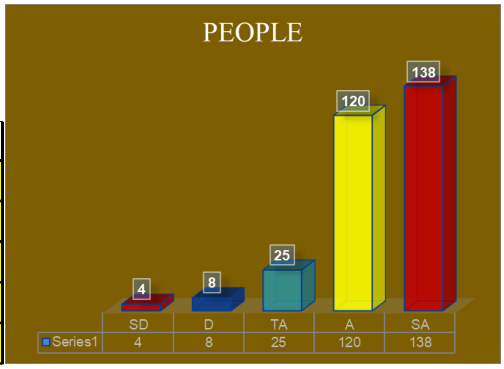

Table 27: Data Table (People Factors: CSFP)

Analysis of the Findings of Organization Factors (CSFO):

The organization factor scale stands at 4.30, proving that professionals have accepted this as a critical influencing factor for digital transformation success. Chart and data analysis shown in table 28 reveals that 52.88% strongly agree, 37.29% agree, and 5.76% tend to agree that if this factor is implemented, then the digital transformation success rate will be higher. The analysis also shows that 3.39% of the professionals opposed the concept, and 0.68% of participants vehemently opposed organization as an influencing factor in the digital transformation success.

Scale	Category	Response	Percentage
1	SD	2	0.68
2	D	10	3.39
3	TA	17	5.76
4	A	110	37.29
5	SA	156	52.88

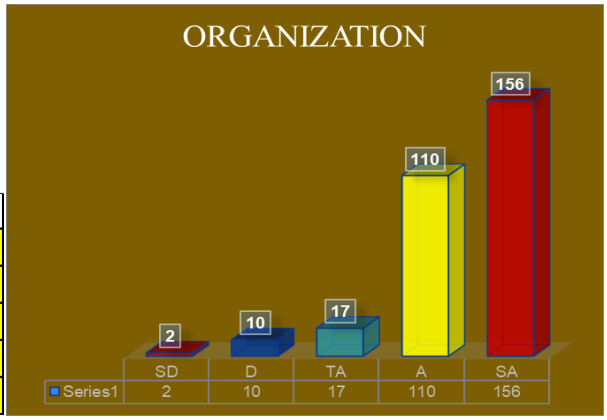

Table 28: Data Table (Organization Factors: CSFO)

Analysis of the Findings of Technology Factors (CSFT):

The technology factor scale stands at 4.27, proving that professionals have accepted this as a critical influencing factor for digital transformation success. Chart and data analysis shown in table 29 reveals that 48.47% strongly agree and 41.69% agree that the digital transformation success rate will be higher if technology factors are focussed. The analysis also shows that 6.10% tended to accept the concept, and 2.71 % and l% of the professionals opposed or strongly opposed the technology factor.

Scale	Category	Response	Percentage
1	SD	3	1.02
2	D	8	2.71
3	TA	18	6.10
4	A	123	41.69
5	SA	143	48.47

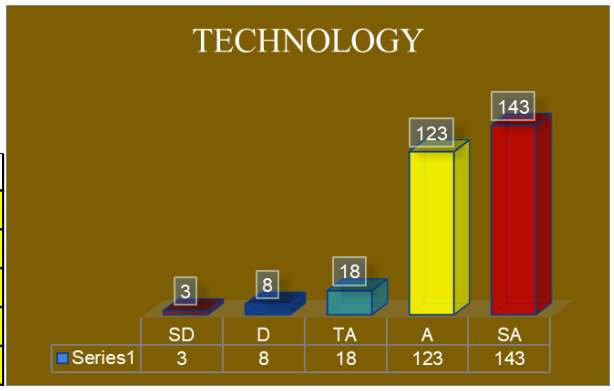

Table 29: Data Table (Technology Factors: CSFT)

Summary of Strategy, People, Organization, and Technology Factors Findings:

From the above analysis, on average, 85-89% of the professionals either strongly agree or agree that strategy, people, organization, and technology factors affect the success of digital transformation. An average of 6-7% somewhat or tending to agree, and less than three percent did not agree with these as influential factors. Findings align with the qualitative analysis in section 5.8, where the professionals whom the researcher interviewed.

Reliability Test:

The researcher conducted a reliability test by using SPSS and Excel software. A reliability test is conducted to find Cronbach's Alpha Coefficient for the collected Data. As shown in table 30, this analysis indicates the reliability of the independent variables.

Critical Success Factors (CSFS)	Number of Items	Cronbach's Alpha
Strategy	3	0.791
People	3	0.784

Organization	3	0.765
Technology	3	0.768

Table 30: Reliability Test Table

From table 30, we can find that the independent variable Cronbach's Alpha co-efficient is above 0.7. Morgan (2011) states that a co-efficient of more than 0.6 is acceptable, and a value above 0.7 is considered good. The strategy has a higher co-efficient (0.791) among other factors; hence this can be considered a reliable factor. Other factors, people: 0.784, organization: 0.765, and technology: 0.768, are also above 0.7 and very close to strategy co-efficient; hence we can say that all four factors are reliable.

Correlation Analysis:

Software project critical success factor (CSFs) correlation value is tabulated using SPSS and excel software using survey data. Below table-31 shows the correlation analysis outcome.

Digital Transformation Success	CSFS	CSFP	CSFO	CSFT
Pearson Correlation	0.968	0.962	0.963	0.967
Sig (2-Tailed)	0.000	0.000	0.000	0.000
Number	101	101	101	101

Table 31: Correlation Analysis Outcome

** Correlation is significant at the 0.01 level (2-tailed)

Since no minus sign precedes the coefficient, this correlation is considered positive (Ward et al., 2010). By referring to table 30 and the standard range of correlation, the researcher has demonstrated the positive correlation between four independent variables, i.e., critical factors and digital transformation success, which is the dependent variable. Furthermore, the strong correlation between both variables is exhibited by the correlation values indicated in table 31. Almost all factors have the exact correlation and are above 0.9. To summarize, the table proves a significant relationship exists between four critical factors, i.e., strategy, people, organization, technology, and digital transformation success.

Regression Analysis:

A regression test was conducted using Excel and SPSS. Through the regression, the researcher has analyzed the authenticity and relationship among the variables acquired from the findings. Refer to table 32 for regression results.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.983[a]	.967	.966	.128

Table 32: Regression Model Summary

a. Predictors: (Constant), CSFS, CSFP, CSFO, and CFST

Multiple correlation coefficient R is 0.983 and Adjusted R square= 0.966.

Regression analysis shows a strong relationship between critical success factors and digital transformation success. As revealed by analysis, 98% of the variations in digital transformation success are influenced by these four critical success factors: strategy, people, Process, organization, and technology. Survey findings and analysis results align with qualitative analysis and interview findings. In the qualitative interview, professionals overwhelmingly recommended deploying these strategies, people, organization, and technology factors in digital transformation projects. They strongly argued that the transformation would achieve its success criteria by following these factors.

Below table 33 indicates the F value of the regression analysis.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	48.074	4	12.018	725.0655	.000b
	Residual	1.591	96	.016		
	Total	49.665	100			

Table 33: ANOVA Table

a. Predictors: (Constant), CSFS, CSFP, CSFO, and CFST

b. Dependent Variable: DV1

Statistical data variation is analyzed using the ANOVA table (Stockburger, 1996). As per the above table-33, the F value is 725.0655, and the sign value state is minimal (Sig=.000). Hence, we can conclude that digital transformation can be successful by implementing and adopting the combination of these four critical success factors: strategy, people, organization, and technology.

The standardized Beta coefficient is shown below.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.077	.084		-.907	.000
	CSFS	.261	.074	.260	3.518	<.001
	CSFP	.258	.066	.261	3.915	<.001
	CSFO	.285	.070	.276	4.092	<.001
	CFST	.212	.084	.207	2.515	<.001

a. Dependent variable: DV1 =Y=digital transformation success

Table 34: Coefficient Table

The below equation can be depicted in table 34.

DV1=

(-.077) + .261 (strategy factor) +.258 (people factor) +.285(organization factor) +.212(Technology factor)

From the above table, the significance is nil, less than 0.05 for all the factors. As per the Stockburger (1995) coefficient, less than 0.05 is acceptable. Hence, the researcher concludes that all critical factors significantly impact and contribute to achieving digital transformation success.

Finding on First, Second, third, and fourth Hypothesis:

H01: Strategic management has no relationship with digital transformation success.

Prior research, digital transformation framework, and literature detailed in chapter 2 of this project work strongly prove the existence of digital transformation success factors. Strategic factors were further proven in qualitative analysis in section 5.8.1. It also

establishes the positive and significant relationship between strategic management and digital transformation success. Hence, the null hypothesis **H01** is rejected.

$H1_1$: Strategic management has a significant relationship with digital transformation success.

Category	Critical Factors
Strategic Factors	Strategic management plan aligned with the goals and objectives of the organization DX initiatives are monitored and governed by the project management team DX is driven by customer or stakeholder requirement and add value.

Table 35: Strategic Factors

Critical factors of strategy in the digital transformation are shown in the above table 35.

A detailed literature review on digital transformation in chapters 2 to 3 shows a close relationship between strategic factors and transformation. These factors drive the success of DX initiatives, as further demonstrated by qualitative analysis in section 5.8.1. As exhibited in section 5.8.1, all 15 (93.75% of participants) members interviewed were quoted; strategy, planning, governance, and customer-centricity will significantly impact digital transformation. Other terms or equivalent content listed in table 35 were also endorsed. As per professionals, digital transformation projects can be successfully implemented if strategy factors are implemented along with people, organization, and technology.

Further in the quantitative analysis researcher verified the relation between digital transformation success and individual strategic factors, and all factors are above 0.6, which is acceptable.

Cronbach's Alpha for overall strategic factor was 0.791, and the P value is <0.05; hence first hypothesis **H_{11}** is accepted, and the researcher can establish that critical factors of strategy have a significant positive relationship with the success of the digital transformation.

$H0_2$: People factors have no relationship with digital transformation success.

Earlier research work, digital transformation framework, and literature detailed in chapters 2 to 3 of this project work powerfully demonstrate the people-related success factors. People factors were further substantiated in qualitative analysis in section 5.8.1. It also establishes positive and significant relation between people factors and digital transformation success. Hence, the null hypothesis **$H0_2$** is rejected.

$H1_2$: People factors have a significant relationship with digital transformation success.

Category	Critical Factors
People Factors	Customer and stakeholder satisfaction through collaboration and engagement. Employee empowerment Leaders are digitally savvy and encourage innovation.

Table 36: People Factors

Critical factors of people in the digital transformation are detailed in above table 36.

A detailed literature review on digital transformation in sections 2 to 3 exhibits the close relationship between people factors and transformation, and these factors drive the success of the DX initiatives. The Research findings were further substantiated by qualitative analysis in section 5.8.1. As per section 5.8.1, 14 (87.50% of participants) members interviewed recommended people, employee, employee empowerment; customer, stakeholder engagement and collaboration; customer and stakeholder satisfaction. These factors will have a significant positive impact on digital transformation. Other terms or equivalent content listed in table 36 were also endorsed. As per professionals, digital transformation projects can be successfully implemented if people factors are implemented along with other factors like strategy, organization, and technology.

Further in the quantitative analysis researcher verified the relation between digital transformation success and individual people factors; all factors are above 0.6, which is acceptable.

Cronbach's Alpha for the overall people factor was 0.784, and the P value is <0.05; hence second hypothesis, **$H1_2$,** is accepted, and we can establish that critical factors of people have a significant positive relationship with the success of the digital transformation.

$H0_3$: Organization factors have no relationship with digital transformation success.

Earlier research work, digital transformation framework, and literature detailed in chapters 2 to 3 of this project work powerfully demonstrate the organization-related success factors. Organization factors were further substantiated in qualitative analysis in section 5.8.1. It also establishes the positive and significant relationship between organizational factors and digital transformation success. Hence, the null hypothesis **$H0_3$** is rejected.

$H1_3$: Organization factors have a significant relationship with digital transformation success.

Category	Critical Factors
Organization Factors	Digital mindset, agile and open work environment. Dx Key performance index and measurement methods are available. Rewards, recognition, and performance appraisal systems are practiced.

Table 37: Organization Factors

Table 37 depicts the critical organizational factors in digital transformation.

A detailed literature review on digital transformation in sections 2 to 3 exhibits a close relationship between organizational factors and transformation, and these factors drive the success of the DX initiatives. The relationship between organizational factors and success was further ratified by qualitative analysis in section 5.8.1. As per section 5.8.1, 13 (81.25% of participants) members interviewed quoted organization, digital mindset, agile work culture, rewards, recognition, and performance appraisal system. These factors will have a significant positive impact on digital transformation. Other terms or equivalent content listed in table 37 were recommended. As per professionals, digital transformation projects could be successfully implemented if organizational factors and other factors like strategy, people, and technology were implemented.

Further in the quantitative analysis researcher verified the relation between digital transformation success and organization factors, and all factors are above 0.6, which is acceptable.

Cronbach's Alpha for the overall organization factor was 0.765 and the P value is <0.05; hence first hypothesis, **H13,** is accepted, and the researcher can establish that critical factors

of the organization have a significant positive relationship with the success of the digital transformation.

$H0_4$: Technology factors have no relationship with digital transformation success.

Prior research, digital transformation framework, and literature detailed in chapters 2 to 3 of this project work strongly exhibit the technology-related success factors. Technology factors were further endorsed in qualitative analysis in section 5.8.1. It also establishes the positive and significant relationship between technology factors and digital transformation success. Hence, the null hypothesis **$H0_4$** is rejected.

$H1_4$: Technology factors have a significant relationship with digital transformation success.

Category	Critical Factors
Technology Factors	Different digital tools and software like, Zoom, team, RPA, IOT, AI, ML etc. Data digitization, paperless records communication, and approvals. Data privacy, security, and cyber security

Table 38: Technology Factors

Critical factors of technology in digital transformation are shown in the above table 38.

A detailed literature review on digital transformation in sections 2 to 3 demonstrates a close relationship between technology factors and transformation, which drive the success of the DX initiatives. Findings were further substantiated by qualitative analysis in section 5.8.1. As per section 5.8.1, 13 (81.25% of participants) members interviewed recommended technology, special software, IOT, AI, ML, data digitalization, and paperless records. These factors will have a significant positive impact on digital transformation. The

professionals endorsed similar or equivalent content listed in table 38. If technology factors are implemented along with strategy, people, and organization, digital transformation projects can be successfully implemented.

Further in the quantitative analysis researcher verified the relation between digital transformation success and technology factors, and all factors are above 0.6, which is acceptable.

Cronbach's Alpha for the overall organization factor was 0.768, and the P value is <0.05; hence first hypothesis, **H14** is accepted, and we can establish that critical technology factors have a significant positive relationship with the success of the digital transformation.

Summary of One, Two, Three, and Four Hypothesis:

Quantitative analysis of strategy, people, organization, and technology factors reveal that all four elements and their subitems are critical for the success of digital transformations. Findings were consistent with the insightful interview with IA company professionals, whereas the prior literature review does not fully align with these findings. Few academics agree that strategy is vital factor (Westerman et al., 2011; Jacobi and Brenner, 2017; Bumann and Peter, 2019; Gimple, 2018; Delloite, 2015; Mckinsey, 2018, BCG, 2020; Yokogawa, 2021). Matt et al. (2015) argued that top management support and transformational leadership were necessary. After he analyses, the data researcher opines that all four factors, strategy, people, organization, and technology, are equally essential, and success cannot be achieved, leaving anyone behind.

Category	P Value	Cronbach's Alpha	Null Hypothesis	Alternative Hypothesis
Strategy	<0.05	.791	Rejected	Accepted
People	<0.05	.784	Rejected	Accepted

Organization	<0.05	.765	Rejected	Accepted.
Technology	<0.05	.768	Rejected	Accepted.

Table 39: Hypothesis One, Two, Three, and Four Summary

As presented in table 39, the null hypothesis **H0**: Critical success factors have no relationship with IA companies' digital transformation, is rejected. Alternative hypothesis **H1**: Critical success factors have a significant relationship with IA companies' digital transformation is accepted.

5.8.4 SPOT Framework for Successful Digital Transformation

Section 5.8.1 exhibits the qualitative analysis, and section 5.8.3 reveals a quantitative analysis of the success factors of digital transformation implementation in IA companies. In contrast, section 2.8 detailed the literature review of success factors from various scholars, consultants, and practicing companies. The data collected from quantitative, qualitative analysis, and literature review form the data triangulation. In this research, success factors are a critical element in the digital transformation implementation, and data is validated by multiple methods, i.e., literature review, qualitative and quantitative.

Research results in sections 5.8.1 and 5.8.3 demonstrate SPOT critical factors (CSFs). If IA companies implement these factors, then the success rate of the digital transformation in terms of value to the customer, organization vision and goals, schedule, budget, and quality will increase. These critical factors are:

1. Strategy
2. People
3. Organization
4. Technology

Each factor has separate success elements, which, if implemented adequately, will improve the success of the software projects. The researcher has developed the SPOT (strategy, people, organization, and technology) module framework in figure 49 for the digital transformation in IA companies.

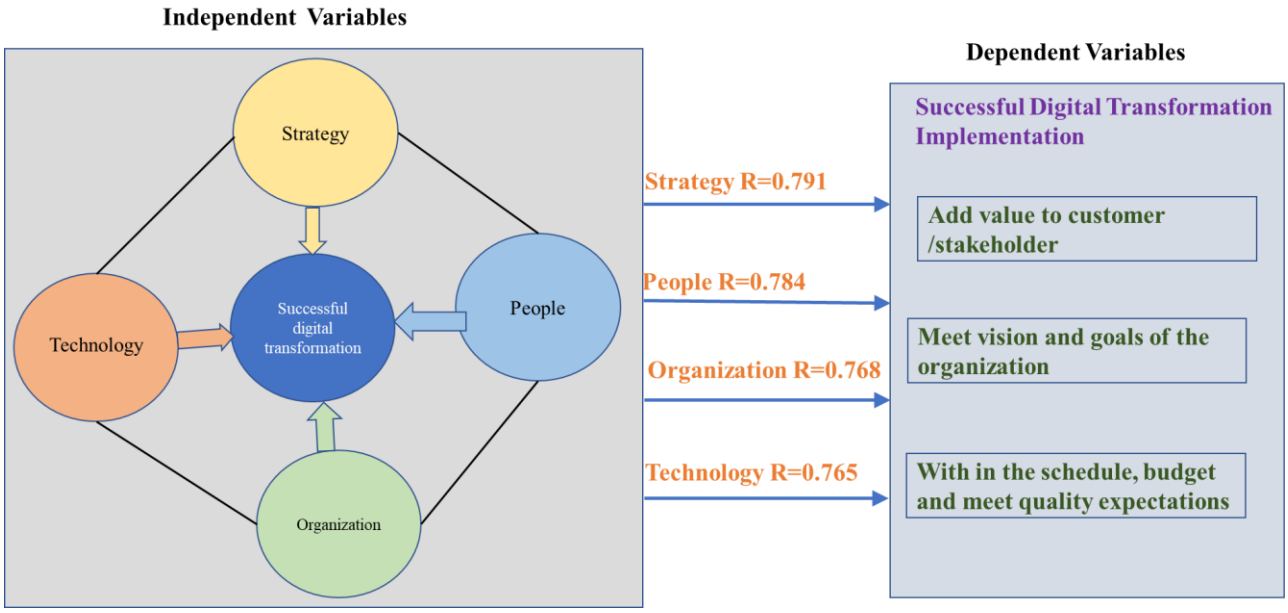

Figure 49: SPOT Framework for Successful Digital Transformation

As the above research shows, each standalone component, strategy, people, organization, and technology are imperative for digital transformation.

An excellent way to think of this SPOT framework is like imagining a four-legged table. The whole table will lose balance if one of the legs is a bit longer or shorter. Similarly, if the technology changes, leaders need to upskill the people and modify the processes to adapt to the new tools with the right strategy.

5.9 Summary

This chapter was dedicated to data collection and analysis. Research questions:

1. Why IA companies required to implement digital transformation?

2. Why did digital transformation fail in most organizations and succeed in some companies? And what can the leaders of IA companies learn from it?

3. What are the action fields in IA organizations that require transformation?

4. What is the current digital maturity level of IA companies?

5. What critical digital technologies have IA companies adopted for digital transformation? Were answered using the literature review and qualitative analysis. Through a literature review and intense interview content analysis, the researcher derived; the driving factors for digital transformation pertaining to IA organizations; action fields for digital transformation; current maturity level of IA firms; critical digital technologies adopted by IA organizations. To answer: 6. What are the success factors of digital transformation for IA companies? The researcher opted for a triangulation approach and used qualitative and quantitative research methods. At first, based on the literature review, semi-structured interview discussion points were developed and sent to prospective candidates working in the IA organization. The interview was conducted with a professional who agreed to participate in the discussion. It was highly interactive and informative, with in-depth discussions lasting 40 to 50 minutes. The interview was conducted remotely using Zoom and team meetings and recorded with the consent of the participants. For the content analysis, the researcher used the interview transcript and derived the success measuring criteria and factors for successfully implementing the digital transformation. The researcher developed survey questionaries for further quantitative analysis based on the findings of the qualitative analysis. Using the survey results, ANOVA and regression were performed to test the hypothesis. It was found that all four null hypotheses were rejected, and the alternative hypothesis was accepted. The researcher demonstrated that there is a significant relationship between strategy, people, organization, and technology (Hypotheses 1, 2, 3, and 4) and digital transformation success.

6 CHAPTER 6: STRATEGIC MANAGEMENT PLAN, CONCLUSION AND RECOMMENDATIONS

As discussed in the previous chapter five, the researcher derived driving factors, action fields, maturity levels, and technology used by IA firms and established the relationship between strategy, people, organization, and technology factors with the success of digital transformation for IA companies. During the discussion with industry professionals, it was identified that a complete strategic management plan was still required for the execution of digital transformation pertaining to IA firms. Even though many transformation frameworks are available, these framework details are not very comprehensive for IA companies' implementation; hence, it was imperative to develop holistic strategic management to support IA firms in their efforts in digital transformation. In this chapter, continuing with the analysis results, the researcher has recommended a strategic management plan for the digital transformation of IA companies. Comprehensive strategic management will respond to the research question: How to implement digital transformation in IA companies? Moreover, meet the research objective of developing a strategic management plan. Research questions, research limitations, and the scope for further research are discussed in this chapter. This thesis ends with the researcher's conclusion.

6.1 Strategic Management Plan

Consolidating the literature review and data analysis findings, the researcher has proposed a strategic management plan for implementing digital transformation in IA companies. A summary of the research analysis from section 5 is presented in figure 51, and a comprehensive strategic management plan is presented in figure 50.

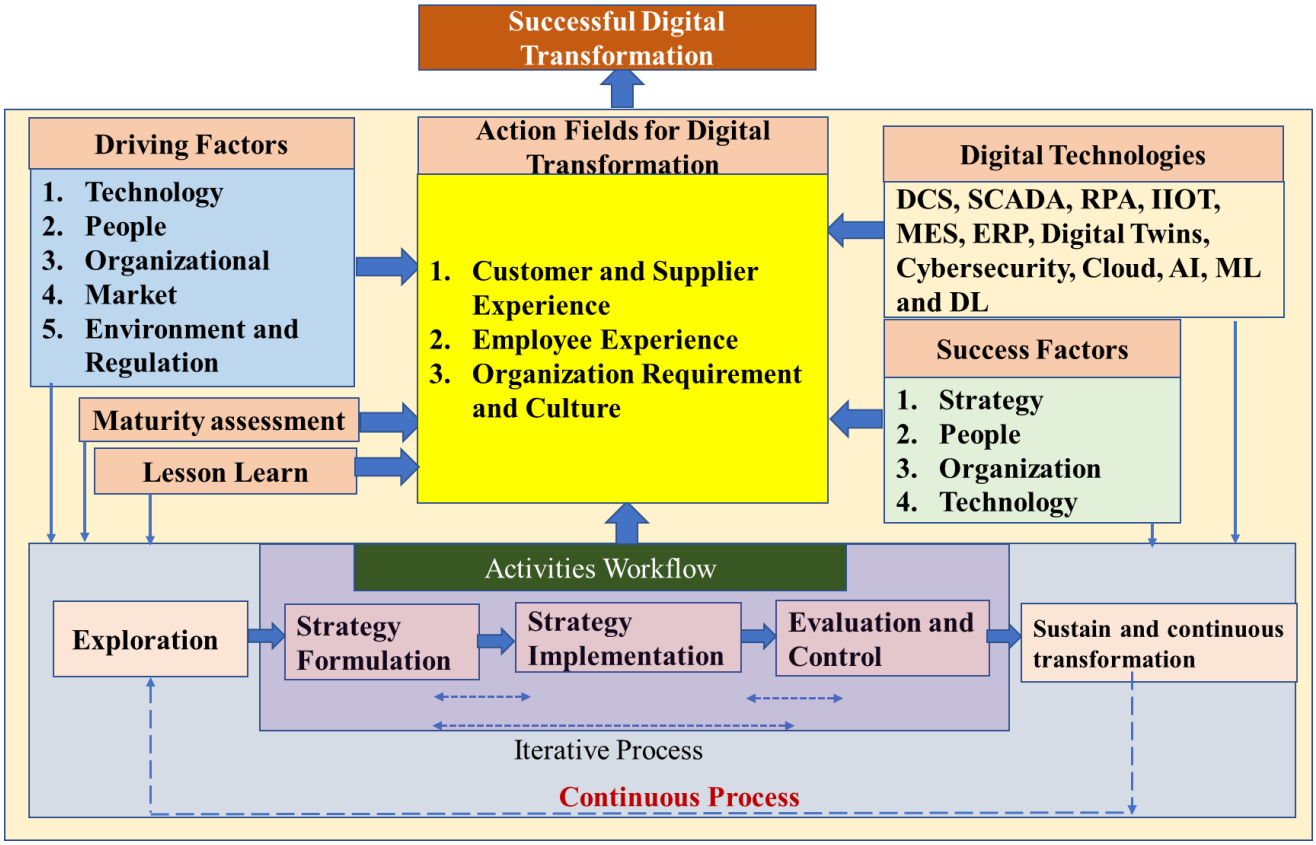

Figure 50: Comprehensive Strategic Management Plan

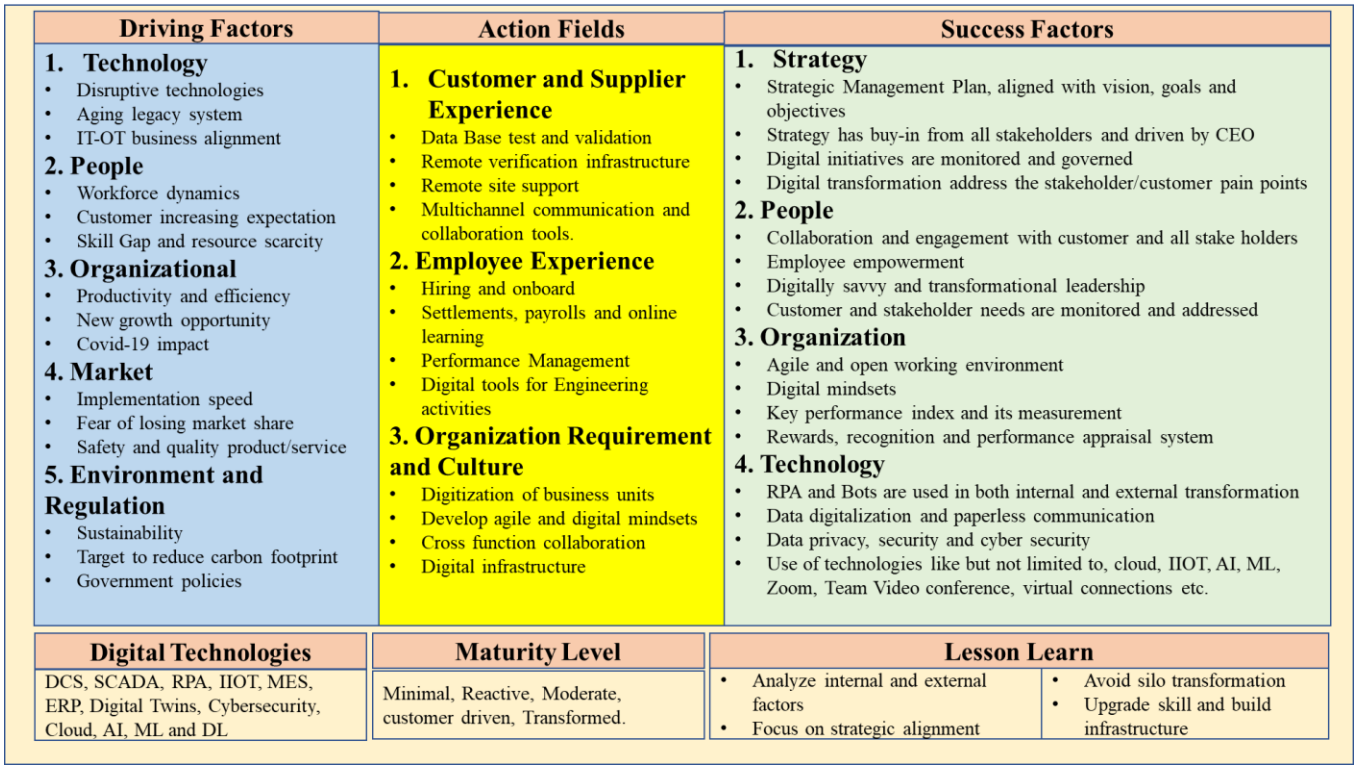

Figure 51: Summary of research analysis from section five.

A comprehensive strategic management plan uses driving factors, maturity analysis, success factors, lessons learned, and digital technologies analyzed and ratified in chapter five. The digital transformation framework evaluated in section 3.8, project management frameworks from section 3.4, and researcher data analysis outcome from chapter five are used to develop the strategic management plan, which professionals can use.

As exhibited in figure 50, the researcher has categorized Strategic management workflow into below five stages:

1. Exploration
2. Strategy formulation
3. Strategy implementation
4. Evaluation and control
5. Sustain and continuous transformation

Different terms are used for these stages; Yokogawa (2021) used labels like "discover," "design," and "develop," similar to the above "explore strategy formulation and implementation." Mckinsey (2016) and Coundouris (2020) used the terms: discover, design, de-risk, and deliver. The Project management institute (PMI) waterfall method has five phases of project management: initiating, planning, executing, monitoring and controlling, and closing (PMBOK, 2017). Agile project management (APM) combines waterfall principles with flexible, lightweight, collaborative, and adaptive procedures suitable for frequent changes (Leybourne, 2009). It uses an iterative process for executing the process. The researcher proposes a mix of APM and waterfall so that professionals can choose both frameworks and select the appropriate one based on the requirements. These activity steps have been proven using different project management frameworks; the researcher has used these stages and applied the analyzed research findings within this activity workflow.

Exploration:

In exploration, stage organizations scan the market for new opportunities and threats to the existing business. Inputs from chapter five research analysis: driving factors, required action fields, maturity level assessment, success factors, and selection and adaptation of different digital technologies can be utilized in the exploration stage.

Based on the analysis, management will identify; what drives the change. Furthermore, how does digital transformation add value to customers and stakeholders? Maturity analysis, action fields, success factors, and driving factors serve as inputs to analysts while exploring the market; In the exploration organization's strategic team identifies the opportunities and threats. Maturity assessment helps measure the firm's current capability, which leaders can use to compare with where they want to be and analyze the gap. Success factors, digital technologies, and action fields help organization leaders to decide their goals and objectives and how digital transformation can be used to meet their aspirations.

At the end of the exploration phase, the organization is expected to develop a digital transformation blueprint, maturity level report, and selected action fields for transformation. Depending on organization assessment and approvals, leaders can decide on one action field at a time or all action fields in go for transformation.

Strategy Formulation:

The formulation stage is about developing a digital transformation plan ready for implementation. Strategic leaders should use a digital transformation blueprint and maturity level report from the exploration stage. Inputs from the research analysis of chapter five, required action fields, success factors, selection, and adaptation of different digital technologies can be used. In addition, strategic leaders must assess and choose a waterfall or agile project framework. Agile is the most suitable project management method for digital transformation due to its flexibility and iterative process.

Strategy formulation is similar to the planning or design phase; the transformation road map, required budget, schedule, and user requirement document are developed. Before developing the strategy, leaders will ascertain the organization's strengths and weaknesses and select the action fields for digital transformation. The formulation stage also includes resource skill and infrastructure gap analysis and a development plan is also included. This stage involves decisions like developing own skill pool or partnering or acquiring. It is recommended to use an agile and iterative approach for digital transformation, which gives more flexibility. In this step, a detailed strategy for digital transformation implementation is developed.

Strategy Implementation:

Value-based digital transformation as per the formulated plan is implemented at this stage. Collaboration between the project team and stakeholders is essential for implementing the strategy, and transformation leaders must engage all stakeholders with appropriate communication. Firms can use the stakeholder engagement plan explained in section 5.8.1

and figure 46. Inputs from the research analysis of chapter five, success factors, current maturity analysis, and adaptation of different digital technologies can be used.

It is recommended to use an agile approach and release digital products or services in incremental to stakeholders so that the project team can receive early feedback and implement any corrective actions. Digital products and services are deliverables of this stage. Leaders can adopt AI, ML, cloud IOT, and digital twins to meet their transformation aspirations.

Evaluation and Control:

The team can use physical review meetings or team/zoom meetings to evaluate the transformation implementation. Implemented digital transformation initiatives are measured against the success criteria like; value to customers/stakeholders, aligned with organization goals/objectives, and if it has met the TQC (time, schedule, and quality) parameters. Inputs from the research analysis of chapter five, success factors, current maturity analysis, and adaptation of different digital technologies can be used to evaluate and control transformation efforts.

Digital transformation is ultimately about keeping and acquiring new customers by offering better value (Busulwa, 2022). Transformation efforts should always be evaluated against the stakeholder and customer requirements, and the transformation team should be agile to accommodate changing demands. Digital transformation requires an iterative approach; if the criteria are not met, the team will go back to the implementation or formulation phase and take the necessary action. The goal is to address the stakeholder's pain points rather than sticking to schedule and scope, even though both are important.

Sustain and Continuous Transformation:

After firms implement a digital transformation, evaluate against the criteria, and successfully deploy at scale, sustaining the transformation is essential. A project has a definite start and end (PMBOK, 2017), whereas digital transformation is a continuous process. The market is poured by new digital technologies and competition daily; hence, strategic leaders must always observe the market quickly enough to capture new opportunities or threats. After thoroughly analyzing the opportunities and threats, organization leaders need to decide if a small change will do or if a transformation process is required.

IA professionals can successfully implement the digital transformation by using the strategic management plan and the driving factors, lesson learns, success factors, digital technologies, and action fields.

6.2 Summary of Research Questions and Objectives

Research questions are addressed in this thesis's different chapters. Below are the research questions raised at the beginning of the project.

Question 1: Why IA companies required to implement digital transformation?

Objective 1: To explore the requirement of digital transformation for IA companies: Driving factors.

It is an essential question as the fundamental research concerns digital transformation pertaining to IA companies. Before spending energy, it is a prerequisite to understanding why IA companies must implement digital transformation. In section 2.1, it is detailed that Global DX spending is forecast to reach $3.4 trillion in 2026 (Statista, 2026). The industrial automation market is expected to grow by $412 billion by 2030. Like other business areas, IA business is also impacted by disruptive digital technologies, and IA leaders are investing heavily in digital transformation. IA leaders must focus on two-fold transformation, at first internal transformation, and support their clients' transformation journey. Several

academics, consultants, and industry professionals have done extensive work identifying digital transformation drivers.

Qualitative analysis in section 5.4 exhibits the driving factors of digital transformation pertaining to IA firms. Undoubtedly emerging technologies are driving digital transformation, but at the same people-oriented factors like; workforce dynamics (aging work/ retiring workforce) and changing customer expectations are playing a critical role. Organizational factors like covid-19 situation, pressure to reduce the cost and maximize the profit, diversification, and acquiring new opportunities, necessitate organizations for digital transformation. The automation world is now facing the competition of new technology and IT companies; if IA companies do not transform, they may lose market share; this fear of loss is the critical driving factor for digital transformation.

To summarise, regular review of driving factors will help the organization's strategic leaders to identify the current driving factor so that they can analyse the impacted action field and formulate a plan to transform it. Driving factors serves as the triggering point for digital transformation.

Question 2: Why did digital transformation fail in most organizations and succeed in some companies? And what IA company leadership can learn from it?

Objective 2: Analyse the success and failure of digital transformation in other business areas and lessons learned.

According to Mckinsey (2020) survey, out of 1.3 trillion $ spent on digital transformation in 2019, 900 billion $ was wasted. Davenport and Westerman (2018), study also revealed that just 30% of the transformation initiatives were successful, with a 70% failure rate. Hence researcher undertook the literature review to realize the cases of both failed and successful stories of digital transformation implemented in different organizations.

Davenport and Westermann (2018), and Blake (2019), literature review of GE, P&G, and Ford's digital transformation reveals; what went wrong with these organizations and what transformation leaders can learn from them. Ramnarayan and Mehta (2020), study on L&T, Symphony Limited, and Cavin Kare Private Limited exhibits the success story of the digital transformation in their organization.

After studying the literature on failed and successful digital transformation, the researcher has consolidated the lesson learned in section 2.8, which can guide IA company leaders in formulating and implementing transformation initiatives in their organizations.

Question 3: What are the action fields in IA organizations that require transformation?

Objective: Identify the areas that are required to transform.

IA leaders need to pay attention to action fields, which are critical to the success of digital transformation.

Section 3.6 examines the study conducted by scholars and identifies various focus areas. Bumann and Peter (2019) study revealed six focus areas: strategy, organization, culture, technology, customer, and people. Gimpel et al. (2018) framework divided action fields into six areas: customer, value proposition, operations, data, organizations, and transformation management.

The qualitative analysis in section 5.5 reveals the action fields recommended by IA industry professionals. In the interview, professionals mainly focused on three action fields: customer and supplier experience, employee experience, and organization requirements and culture. Analysis suggested focusing on IA-specific areas like database testing and validation, remote site support, and remote verification infrastructure for process automation projects. Organizations should build digital infrastructure like cloud

services and remote setups. The focus should be on developing agile and digital mindsets and improving employee skills. Employees, customers, and suppliers are the backbones of the IA companies, and transformation must address their pain points and add value to their experiences. Organizations can implement successful digital transformation by focusing on these action fields, applying the right technologies, creating a strategic transformation plan, and utilizing the success factors.

Question 4: What is the current digital maturity level of IA companies?

Objective 4: Assess the current digital maturity level of IA companies

Measuring the digital maturity status is vital for the successful transformation journey. Maturity analysis allows leaders to measure their strengths and weaknesses, their capabilities, and the organization's position. As per Gill and VanBoskirk (2016), assessing the maturity level imparts clarity about the organization's current status, and leaders can use the maturity report to formulate a plan for achieving firm objectives and goals. Deloitte (2018), digital maturity model (DMM) used; customer, strategy, technology, operations, and organizational culture to measure capability.

Raut's (2020) maturity level analysis method was used in the research to understand the maturity level of the IA firms. In the qualitative analysis for this research in section 5.6, IA professional's responses were of a mixed level of maturity. Most professionals consider themselves reactive, and none were at a minimal level. Half of the respondents considered their organization to be at a moderate maturity scale level, a quarter considered their organization transformation customer-driven, and none considered their organization 100% transformed. Leaders can use the report to assess the gap and take the necessary actions for successful digital transformation.

Question 5: What critical digital technologies have IA companies adopted for digital transformation?

Objective 5: To investigate the key digital technologies that IA companies adopted for digital transformation.

Companies like Uber, Ola, Airbnb, and Swigy (a food service company in India) have disrupted their industry sectors using technology and a data-driven approach. Section 2.5 and section 2.6 of the literature review detail the importance of digital technologies and their impact on business. In section 5.7, interviews with IA professionals furnished information pertaining to different technologies and software adopted by IA firms. Being automation firms, DCS, PLC, and SCADA are naturally the most used technologies; however, due to paradigm shifts in the usage of digital technologies, IA firms are increasingly adopting cloud, cybersecurity, IIOT, MES, RPA, and digital twins. Tools like AI, RPA, cloud, and cybersecurity are used for internal transformation and to enable the customer transformation journey. MES, IIOT, digital twins, and machine learning are used for customer's digital transformation. Harvard business review (2017), noted that organizations that did not embrace the transformation perished or were reduced to small entities, and their businesses were taken over by digital giants. Further to the Harvard review, it must be noted that disruption is not yet finished, it is ongoing and cannot be ignored, it must only be adopted (Schindlwick, 2021).

Question 6: What are the success factors of digital transformation for IA companies?

Objective 6: Identify the success factors.

Section 2.8 literature review evaluates the lesson learned from previous transformation failures and success stories of some of the firms that successfully implemented digital transformation in their firms. Since only 30% of the transformation effort were successful, and 70% of the initiatives have failed, it is important to analyze what went wrong with failed companies and the factors followed by successful companies. (Davenport and Westerman, 2018; Blake, 2019; Ramnarayan and Mehta, 2020).

The researcher has analyzed the success factors pertaining to IA companies in section 5.8. Both qualitative and quantitative method was used to gather the success factors. Four main factors were identified as an outcome of the analysis: strategy, people, organization, and technology. Using these factors researcher further developed the SPOT (strategy, people, organization, and technology) framework to help the IA professionals in their digital transformation initiatives.

Question 7: How to implement digital transformation in IA companies?

Objective 7: Develop the framework/strategy

Several scholars, consulting firms, and industry professionals worked to develop the frameworks for digital transformation. A summary of the literature review on the framework is detailed in section 3.8. Per Petrova (2021), the framework helps analyze the firm's strengths and weaknesses, customer requirements, expectations, and business goals. During the discussion with IA, professionals stressed developing a holistic strategic management plan for the planning and execution of the digital transformation.

In section 6.1, the researcher has developed a comprehensive strategic management plan, which is presented in figures 50 and 51. This strategic management plan is developed based on the literature review in Chapter 2; chapter 3, and the data analysis in Chapter 5. A strategic management plan exhibits the driving factors, focus areas, maturity level analysis, lessons learned, different digital technology adaptations, and success factors used throughout different phases of the digital transformation. Strategic elements are used in exploration, strategy formulation, implementation, monitoring, and control. Even though digital transformation has project management components, it is a continuous process that will last longer. It is critical to keep analyzing the market and observing changing customer expectations and new opportunities. The developed digital transformation strategic management plan is expected to assist IA leaders in their transformation journey and successful implementation.

6.3 Research Limitations

Data Size Limitation:

The data sample size is one of the limitations, among others. For qualitative analysis, 16 professionals were acceptable, as the researcher received similar responses. A sample size of 100 may not be enough for the quantitative analysis of success factor identification. The analysis will be more accurate and reliable if a more extensive data sample is used.

Time Constraint:

Time constraint was a primary concern in the research. Industry automation professionals are often too busy with their activities, and many have not managed to respond to an interview request and the questionnaire survey within the limited time frame. Due to this reason, even though the researcher targeted 35 IA professionals for qualitative analysis, he only managed to get 16 responses. For quantitative analysis researcher sent a questionnaire to 250 professionals and managed to get the survey response of 120 members. In 120 replies, it was observed that some responses were incomplete and unsuitable for taking the inputs; hence researcher filtered out such data and finally performed the analysis with 101 professional's data inputs.

Choice of Industry:

Industrial automation organizations were selected for the research, which may not be conducive to getting the full conclusion for the digital transformation subject. Because of the time constraint, the survey and analysis were not extended to other firms and organization. Covering other areas of industries may have given a broader horizon for the outcome.

6.4 Research Conclusion

This research was performed to discover what drives digital transformation, what areas professionals need to focus on, how mature IA companies are now, what digital

technologies they have adopted, and what factors lead to success. Using the outcome of the data analysis, the researcher has developed the strategic management framework for the IA organization's digital transformation. The researcher used the prior research work and literature review as the basis for this research framework. The researcher further evaluated the driving factors, action fields, maturity level, digital technologies, and success factors using qualitative analysis, and for success factors, both qualitative and quantitative approaches were applied. Instead of relying on prior work, the researcher approached professionals working in the IA field and gained insight into the subject through in-depth interviews. In addition, based on the discussion, survey questions were formed for success factors for further discussions. Chapters four and five detail the research design, interview approach, statistical tools and techniques, data gathering, and analysis processes. Four hypotheses related to strategy, people, organization, and technology factors were tested. The hypothesis established a relationship between SPOT and digital transformation success. Using the data analysis outcome, a comprehensive strategic management plan framework was formulated. The study determined that adopting a strategic management plan, focusing on driving factors, action fields, and maturity level, action fields, and implementing critical success factors is crucial for successful digital transformation.

In their strategic management workflow, IA leaders can use different framework elements like driving factors, action fields, maturity level assessments, lessons learned, success factors, and different digital technologies. By using the strategic management plan and framework elements, IA professionals must be able to implement value-added and customer-centric digital transformation in their organizations.

Even though this research pertains to IA companies' digital transformation, other organizations can adopt it with necessary domain-specific modifications.

6.5 Recommendations

The strategic management framework elements identified in this research and strategic management is derived from a literature review of authors and intense interviews of professionals in the industrial automation domain. Prior scholars and industry practitioners endorse the influence of these factors. Success factors were further validated by the hypothesis test. Hence, it is strongly recommended that all organizations adopt, implement, and follow these critical framework elements and strategic management to implement digital transformation successfully. The researcher recommends the below points to the IA industry professionals based on the findings.

1. Analyzing the driving forces of digital transformation and the value it adds to the customer and stakeholder is paramount to the success of the transformation. Hence start with explore phase, identify the driving factors, perform maturity and gap analysis, and then prepare a blueprint for digital transformation.

2. Before starting digital transformation, refer to and evaluate previously implemented digital transformation initiatives. These lessons learned and success stories enlighten guidelines and give heads up to the leaders.

3. Identifying the action field is critical for focusing on the required domain and formulating the strategy for implementation. Selected action fields should address customer and stakeholder pain points and add value to their experience. Organizations must strive to develop resources with digital mindsets and agile work cultures.

4. Use maturity analysis to measure organization capability before taking digital transformation initiatives; this will help to understand the capability and gaps. In a way, it will measure “where we are” and be used to compare with “where we want to be,” i.e., organization's digital aspiration; and then formulate the strategy for “How we can reach there”.

5. In the market, many digital technologies are competing. Digital technologies play a critical role in the organization's digital transformation. However, leaders should not rush to plug and play these technologies and fall prey to the wrong assumption that “technology will do everything for me”. Before using technology, leaders need to analyze transformation requirements and evaluate appropriate tools and technologies applications. Several technologies like cloud, IIOT, digital twins, AI, RPA, machine learning, and many more are available, leader’s analysis and the right choice are critical. Before using technology, employees should be trained to utilize it, or else transformation will not provide the expected results.

6. Utilizing and applying the success factors is critical in implementing digital transformation initiatives. Success factors in this research are derived after a literature review and qualitative and quantitative analysis. SPOT framework of success factors will serve as a guiding light for leaders involved in the transformation.

7. Digital transformation initiatives must be started with strategic management. Strategic management will furnish comprehensive strategic planning for the entire digital transformation process. Without strategic management, there is a high risk of failure; since digital transformation processes are complex and expensive, failure will have a high impact on the organization. Strategic management will help to plan, implement, monitor, control, and sustain the transformation initiatives. Without a strategy, the organization may lose its alignment with goals and objectives, governance over the initiatives, run out of budget, and fail to deliver in time. Digital transformation strategic management will ensure that organization efforts are customer-centric, add value, and addresses pain points. Hence it is recommended to formulate a digital transformation strategy and ensure its execution.

Modification in the formulated strategy is acceptable as organizations are striving for agile execution so that failure can happen in the early phase and required modifications are implemented.

6.6 Suggestions for Future Research

From the researcher's viewpoint, the researcher's findings in this research are correct, as it was found that driving factors, action fields, lessons learned, maturity analysis, adoption of digital technologies, and success factor influence the business and customer expectations and in turn digital transformation implementation. Digital transformation and digital technologies are dynamic and continuously evolving. Many tools and techniques keep on adding, and hence other factors linked with the implementation and its success. Hence it is essential to keep exploring, analysing, and finding new opportunities and optimization in the existing process, formulate and execute the transformation. This research is based on the industrial automation companies' professional viewpoint. It will be good if it is extended to other industries involving digital transformation and its strategies. It will be appreciated if these results are compared with other industry research projects.

7 CHAPTER 5: BIBLIOGRAPHY

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APPENDIX-A: PROTOCOL FOR SEMISTRUCTURED INTERVIEWS

STRATEGIC MANAGEMENT FOR THE SUCCESSFUL DIGITAL TRANSFORMATION OF INDUSTRIAL AUTOMATION COMPANIES

Dear Potential Participant,

My name is Rajeev Ramesh Joshi, and I am a research student at SSBM Geneva. As a part of my program, I am studying to explore driving factors, action fields, digital tools adopted, maturity level, and success factors pertaining to industrial automation companies. Using the results, I will develop a strategic management plan to help IA companies in their transformation journey. I want to invite you to participate in the above subject title research project, as you are possibly influential in implementing digital transformation in your organization. If you accept to participate, you will be requested to Participate in an interview (Approximately 40-45 minutes) with me to have an insightful discussion on your digital transformation experience. The interview will be conducted through MS Team, Zoom, WhatsApp or call at your convenience. With your consent, interviews will be recorded and then transcribed onto a computer system. You may review, edit, or erase the transcripts and recordings of your interview if you wish to do so. Recordings will then be destroyed. Your responses will be treated as confidential, and computer transcripts will not contain references to any persons (including yourself) or organizations.

Please note that all data gathered for this research will be stored securely and destroyed after submitting the report. DBA supervision team and I will be the only people with access to this data.

Thank you for considering this invitation and if you choose to participate in this research. I want to extend my personal gratitude; your contribution is greatly appreciated.

Best Regards: Rajeev Joshi

SEMI Structured Interview Questions/Points

Interview Date

Interview Time

Name

Age

Current Position

Organization Name

Organization Employee Size

Q1: A) What does digital transformation mean for you and the Organization? B) what factors are driving Digital Transformation in your organization. (Internal Factors and External factors).

Q2: Which Areas/Action fields/Business Units are undergoing (planned) Digital transformation in Your Organization (Name a few or all)? According to you, which areas are essential for Customer experience (CX) transformation?

Q3: In Your knowledge, what is your organization's current digital maturity level? Select one.

1: Minimal

2: Reactive

3: Moderate

4: Customer driven

5: Transformed

Minimal: limited or no experience in digital.

Reactive: Few or some departments are digitalized i.e. efforts are siloed in nature and used only to solve their department problems

Moderate: Digital transformation initiatives are shared between departments but lack customer focus.

Customer-driven: Digital initiatives are customer-centric (address customer pain points) and implemented organization-wise.

Transformed: Continuous action or customer experience i.e, organization is 100% transformed.

Q4: What Digital Tools/Technologies/Software is your organization using/adopted in the transformation journey?

Q5: As per the survey of BCG, Forbes, and Mckinsey, 70% of transformations have failed. A) What are the key performance indices for digital transformation? B) In your opinion, what makes a successful digital transformation? (Elaborate on critical success factors

Thank you for your views on the above points. Thank you for your valuable time and insightful discussion. If you are interested in this research's outcome, I would be pleased to share it with you.

8 APPENDIX-B: QUANTITATIVE METHOD USING SURVEY QUESTIONS

Hi, I am pursuing higher education, and as a part of it, I need to submit the dissertation. My dissertation topic is: “Strategic management for the successful digital transformation for industrial automation companies”. I have listed success criteria to measure the transformation success and factors affecting the success of the digital transformation implementation. Your survey answers will help me to collect and analyze the data and submit the dissertation.

Thanks for your time and for helping me.

Respondent Demographic & Basic Information

1. Name of the Employee

_____

2. Education

Mark only one oval.

- ◯ Post-Graduation and above
- ◯ Graduation & Project management
- ◯ CertificateGraduation
- ◯ Below Graduation

3. Age

Mark only one oval.

- ◯ Above 50
- ◯ 40 to 50

30-40

below 30

4. Designation

Mark only one oval.

Director and above

Manager/Sr Manager

Team Lead

Individual Contributor

5. Gender

Mark only one oval.

Male

Female

6. Name of the Organization

7. Size of the Organization

Mark only one oval.

Above 10000

1000 to 10000

Less than 1000

Digital Transformation Success Criteria:

1. Transformation should achieve its organizational goals and objectives

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. Customer and stakeholders should be satisfied with transformation outcome

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. Transformation effort should meet TQC merits (Time, quality, and cost)

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Strategic Factors

1. Aligning Strategic management plan with goals and objective of the organization will have impact on digital transformation success.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. For successful implementation digital transformation initiatives should be governed by project management team.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

3. For successful implementation, digital transformation should be driven by customer and stakeholder's requirement and add value to them.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

People Factors

1. Focusing on customer and stakeholder satisfaction through collaboration and engagement will have impact on the success of digital transformation

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree

2. Employee empowerment will have impact on the success of the digital transformation.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. For successful digital transformation leaders should be digital savvy and encourage innovation

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Organization Factors

1. For successful digital transformation organizations should develop employees with digital mindsets, agile and open work environment

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. Digital transformation key performance index and measurement methods should be available.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. For successful digital transformation organizations should have rewards, recognition, and performance appraisal systems are practiced.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

Technological Factors

1. Adopting to different digital tools and software like AI, ML, ZOOM, Team, and RPA will help is successful digital transfromation

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

2. Data digitization, paper less records, communication and approval are important elements in digital transformation efforts

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	◯	◯	◯	◯	◯	Strongly Agree

3. Organization should maintain data privacy, security and cybersecurity for effective and successful digital transformation.

Mark only one oval.

	1	2	3	4	5	
Strongly Disagree	⬭	⬭	⬭	⬭	⬭	Strongly Agree