

Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption

Newaz Nahid Consulting

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Submitted in Partial Fulfillment of the Requirements for the Degree
Bachelor of Business Administration



September 2024

Internship/Project Report Approval Form

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Date: 15th September, 2024

Letter of Transmittal

15th September, 2024

Shubhankar Shil

Assistant Professor

School of Business

University of Liberal Arts Bangladesh (ULAB)

Dear Sir,

Subject: Submission of internship report on “Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption”

I am pleased to submit my research paper titled “Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption” as part of my academic requirement. This paper provides an in-depth analysis of the factors influencing the optimal timing of technology adoption within organizations. It synthesizes insights from established models such as the S-Curve, TAM, UTAUT, and early and late technology adoption case studies. The aim is to introduce a novel framework designed to guide decision-makers in adopting emerging technologies at the right time.

Throughout my research, I have explored the critical challenge faced by executives regarding the risks of premature or delayed adoption of new technologies. The TAT model aims to address this issue by incorporating key factors such as technology readiness, organizational context, environmental factors, and market dynamics.

I have tried my utmost to present a comprehensive and accurate analysis based on the latest literature and case studies. I am confident that this paper will serve as a useful resource for professionals and academics seeking to optimize their technology adoption strategies.

I would like to extend my sincere gratitude for the guidance and feedback I received throughout this research. Your support has been invaluable in the successful completion of this project.

I hope that my efforts meet your expectations and that the insights presented in the research paper contribute meaningfully to the field.

Thank you for your time and consideration. I look forward to publishing a research paper based on this report with you.

Sincerely yours,

Emon

ID: 201011014

ULAB School of Business

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Part A

Chapter One: Internship Preparation

1.1 Motivation and Expected Learning from the Internship

My decision to pursue an internship at Newaz Nahid Consulting was driven by my academic background in marketing and a desire to apply theoretical knowledge to real-world challenges. As a BBA student majoring in marketing, I was keen on gaining hands-on experience and also building my diverse portfolio in areas such as audience targeting, content creation, and digital marketing strategies, which I believe are integral to the success of any business in today's competitive environment.

The opportunity to work at Newaz Nahid Consulting presented a unique challenge. The firm was in the process of expanding its services to include two new broad wings; career guidance, and NGO engagement. However, the company's marketing efforts were not well-established and the businesses were mostly coming from referrals, thanks to their high standard of work. After auditing its marketing tactics, it was found that the company desperately needed a comprehensive approach to building its brand from the ground up. I can say that fortunately or unfortunately, this situation aligned perfectly with my aspiration to learn about and contribute to the development of marketing strategies in a real-world setting.

In terms of learning, I could not disclose the expected learnings at first as I was beginning all the work from scratch and the company did not have any permanent or dedicated marketing team. However, as the company had meetings with global partners and clients, both current and prospects, I knew in the very beginning that the company would need to work on targeting outbound clients or outbound prospecting methods. Therefore, I expected to learn more about outbound clients throughout the internships and I must say the team at Newaz Nahid helped walk me through some of the things I needed such as client info, their targeting funnel history, and the filters or niches they were focusing on.

1.2 Internship Search Process

The search for an internship was both a challenging and enlightening experience because I formed a different approach. Instead of looking at conglomerates or giant companies to enrich my profile, I wanted to target medium-level enterprises that have major potential to work with. So, I looked at job responsibilities first and then applied for the internship. I have applied to some renowned companies for a backup plan.

So, Initially, I focused on traditional methods, such as sending out emails and dropping off CVs to potential employers. One key thing, I differentiated myself is that I tailored my CV each time according to the internship profile and in some cases, I changed the theme of my CV with the company's color palette just to be standout from others; and it worked. My general background in SEO, Content Mapping, and Writing helped me get there.

However, getting into Nawaz Nahid Consulting, I need to thank my previous freelance experience and one of my closest faculty members who helped me to get the interview. So, with the recommendation, I got to know about this consulting firm and I dropped my CV later on and then I got an online interview call explaining the possible job role I would do.

Despite the firm's primary focus on other majors such as finance and accounting, I was determined to carve out a niche in marketing consulting within the organization. Concurrently, I continued to explore other internship opportunities because of my friend's unavoidable persuasion and thus managed to secure interviews with several companies, including ZAYTOON Business Solutions, Square Pharmaceutical, Moar BD, Microdeft, and Mediusware.

One of the most promising opportunities was with ZAYTOON, where the team was particularly impressed with my content writing portfolio and marketing approach. However, after careful consideration, I chose to join Nawaz Nahid Consulting. Although it is not as large or well-known as some of the other companies I interviewed with, I was drawn to the potential it offered. The firm was in a phase of growth and diversification. I saw this as an opportunity to make a meaningful impact by applying my skills in a dynamic and evolving environment that would help me justify my diverse marketing consulting portfolio.

1.3 Internship Interview Experience

During this meeting, I had the opportunity to sit down with Mr. Nahid Nawaz, and accompanied by two department heads. The atmosphere was both professional and welcoming which helped ease any initial nerves I had about the interview process.

Mr. Nawaz began by discussing the company's current state and the potential wings they were looking to develop, including areas in career identity and guidance, and NGO engagement. He wanted to do both inbound and outbound prospecting methods. So first he asked me what would be my propositions for this. I began the discussion in simple words rather than spelling marketing terms. The conclusion point was to make the ground strong, meaning the brand image and exposure to the target audience, the other goals will fall in line.

The conversation then shifted to my academic achievements and professional experience, particularly in the areas of SEO, content creation, and content mapping. Mr. Nawaz was keen to understand how my skills could contribute to the company's growth and enhance its marketing efforts.

1.4 An Overview of Nawaz Nahid Consulting:

Founded in June 2000, Nawaz Nahid Consulting is a small but highly effective consulting firm dedicated to delivering professional services to a broad and diverse client base, serving over 150 clients across more than 20 industries. The firm's clientele includes major multinational corporations such as Shell, IKEA, and Telenor, alongside numerous local businesses in sectors like garments, telecommunications, and finance to both local and international clients.

Key Services Include:

- **Establishment of Foreign Entities:** Assistance in setting up limited companies, branch offices, and liaison offices in Bangladesh which includes obtaining necessary licenses such as Trade License, TIN, VAT Registration, IRC, and ERC.
- **Expatriate Services:** Facilitating work permits, security clearances, and visas for expatriate employees, alongside managing project registrations with the Board of Investment (BOI).
- **Corporate and Tax Consultancy:** Comprehensive tax planning and consultancy for both corporate entities and individuals, preparation and submission of tax returns, and representation before tax authorities.
- **Company Secretarial Services:** Expertise in managing compliance with the Companies Act, of 1994, and dealing with the Registrar of Joint Stock Companies.
- **ISO and TQMS Consultancy:** Providing consultancy for ISO certification and Total Quality Management System (TQMS) implementation.
- **Financial Advisory:** Advising on financial decisions, working capital management, budgeting, corporate structuring, and financial engineering.
- **Audit and Assurance Services:** Conducting statutory audits, internal audits, management audits, and special investigations
- **HR Consultancy and Headhunting:** Offering human resources consultancy, such as headhunting services to help organizations find and retain top talent.

Mission and Vision

- **Mission:** The mission of Nawaz Nahid Consulting is to become one of the leading international consultancy firms in both the global and local markets, with a particular emphasis on the Asian region.
- **Vision:** To be recognized as a top-tier consulting firm that supports sustainable business growth and development for clients across diverse sectors, with a focus on efficiency, responsiveness, and profitability.

Chapter Two: About the Internship

2.1 Position, Work Environment, and Job Duties

My main objective was critical in supporting the firm's efforts to expand its service offerings and improve its brand visibility to the target audience.

Job Position: Intern – Developing and Executing Brand Strategies, Creating Content, and Managing social media

During my internship at Nawaz Nahid Consulting, I was positioned as a Marketing Intern, however, as I disclosed there wasn't any dedicated marketing department therefore, I was in charge of handling most of the work.

Work Environment:

An office layout designed to promote communication and teamwork. The office, spread across two floors, includes workstations, a conference room, a recreational area, and a prayer room. I did get to sit with other department members, for example, I sat with the website developer and talked to him about ideas to improve the websites and a funnel to navigate prospects in the correct way that would make land calls or meetings.

Job Responsibilities:

- **Content Mapping and Competitive Research:** Conducted in-depth analysis of competitors and mapped out content strategies to position the firm more effectively in the market. I also mapped content regarding NGOs and Career Settings. For example: Fundraising strategy and the importance of telling a success story.
- **Website Audit:** Performed a comprehensive audit of the firm's website, and later focused on page responsiveness, website funnel optimization, and user experience improvements.
- **Blog Writing and Content Ideation:** Created blog posts and developed content ideas that aligned with the firm's strategic objectives, particularly in the areas of career guidance and NGO engagement such as how to create sustainable fundraising, what is career identity and why should students need to have one.
- **Video Production and Editing:** Handled the entire video production process, from shooting and editing to publishing content on platforms like LinkedIn, X (formerly Twitter), and YouTube. The average views of the videos are 2k+.
- **Social Media Management:** Managed the firm's social media presence, ensuring consistent and engaging content across LinkedIn, X, and YouTube. In one of the videos, I managed to get search apperency by almost 15000+.
- **Newsletter Setup:** Established a newsletter framework using SubStack, curated content, and managed the distribution process to keep clients and prospects informed about the firm's offerings.

2.2 Skills Employed, New Skills Acquired, and Contributions

Skills Employed:

- ✓ **Video Production:** I gained hands-on experience in video shooting, editing, and optimization for social media platforms.
- ✓ **Content Strategy Development:** I developed strategic content plans that aligned with the firm's objectives, enhancing its brand presence and outreach.
- ✓ **SEO and Website Analysis:** I used my expertise in SEO and digital analytics to enhance the company's online presence and improve the overall user experience

New Skills Acquired:

- ☐ **Inbound Marketing:** I learned and at the same time applied inbound marketing strategies to organically attract potential clients. By crafting compelling blog content, optimizing for SEO, and engaging with our audience on platforms like LinkedIn and YouTube, I helped draw attention to the firm's expanding services.
- ☐ **Outbound Marketing:** On the outbound front, I took a proactive approach to prospecting. I created lead forms for lead generation first but it was unsuccessful because of the client's absence in lead formation. After that, I learned about the outbound marketing approach for consulting firms. I approached with tailored outreach campaigns, developed personalized email sequences, and directly engaged with potential clients to generate leads and spark interest in the firm's offerings.
- ☐ **Newsletter Setup:** I established and managed the firm's newsletter using SubStack though I was aware but never practically learned. However, the newsletter has proven helpful in curating content that keeps clients and prospects informed about the latest industry trends and the firm's offerings. This helped build a consistent communication channel that reinforced the firm's brand and engaged the audience regularly. Because of SubStack premium charges, I have suggested using the LinkedIn Newsletter which is still in consideration.

Contributions:

- **Content and Social Media Impact:** My blog posts and video content garnered substantial engagement, with videos averaging over 2,000 views and one achieving a search appearance of over 15,000. This not only increased visibility but also drove traffic to the firm's website and social media platforms. Besides, one of the best things that happened was getting comments from the existing members, the way they connected and supported was wonderful to see.
- **Enhanced Market Positioning:** Through comprehensive content mapping and competitive research, I developed strategies that positioned the firm more effectively in the market, particularly in the areas of NGO engagement and career guidance. My work on topics like fundraising strategies and career identity helped align the firm's content with its strategic objectives. We visited the Green Financing Campaign, SME

Fair to shoot our video on the related topics. One of our most successful uploaded videos was about the success story of handling a big project with the big NGOs in Bangladesh.

- **Improved Website Performance:** The website audit I conducted led to significant improvements in page responsiveness, user experience, and funnel optimization, making the firm's online platform more effective in converting visitors into clients.
- **Strategic Insights and Content Mapping:** I offered key insights by content mapping that helped the company sharpen its marketing strategy.

2.3 Relating Educational Learning to Internship Roles

My academic background in marketing, particularly my coursework in, Selling and Salesmanship, Consumer Behavior, and Brand Management directly supported my role at Nawaz Nahid Consulting. The theories and strategies I learned in class were put into practice during my internship.

However, I also learned skills like SEO, Content Writing, Keyword Research, and inbound and outbound marketing from Coursera, Udemy, and YouTube.

My diverse educational background allowed me to bridge the gap between theory and practice in a meaningful way during my internship. For example, insights from Consumer Behavior helped me create targeted content that resonated with our audience, while Brand Management principles guided me in refining the firm's market positioning and leveraging secondary brand associations. The hands-on skills I acquired through online courses, like SEO optimization and content writing, were directly applied to real projects. This combination of academic learning and practical application made my internship experience not only productive but also deeply enriching.

Chapter Three: Self Reflection

3.1 Likes and Dislikes

Likes:

One of the aspects I truly appreciated during my internship at Nawaz Nahid Consulting was the collaborative and supportive work environment. Meetings were well-organized, and I always felt that my input was valued. The leadership team, particularly Mr. Newaz, took the time to listen to my ideas and enabled me the space to implement them. This level of respect and openness made me feel like a valued team member rather than just an intern. Additionally, the helping personality among coworkers was exceptional; they were always willing to assist and offer feedback, which greatly enriched my learning experience.

Dislikes:

On the other hand, some challenges impacted my overall experience. The absence of a dedicated marketing team was a significant drawback. Although I attempted earnestly to take on a wide range of tasks, the fact that I was managing everything single-handedly meant that I often couldn't dive as deeply into projects as I would have liked. This limitation sometimes made it difficult to achieve the depth of strategy and execution that I knew was possible. Furthermore, the lack of proper equipment, particularly for video production, was troubling. The only equipment available was a stand or tripod. That restricted the quality and scope of the content I could produce the way I wanted. If I had gotten a small production setup, it would have enabled me to create more professional and polished materials.

3.2 How I Could Have Done Better and How the Organization Could Utilize Me Better

Reflecting on my performance, I realize that I could have made an even greater impact if I had the support of a dedicated marketing team and more time to focus on each project. Collaboration is key in marketing, and having additional team members would have allowed for more brainstorming, diverse perspectives, and shared workloads. Time was another critical factor; given more time, I could have refined the content and strategies further to ensure high quality and great effectiveness for the organizations.

From the organization's perspective, my role could have been optimized with more structured support. For instance, a small marketing team could have helped guide my efforts and provided valuable feedback throughout the process. Additionally, equipping the office with essential tools, such as a camera and basic video production equipment, would have greatly enhanced the quality of content produced. This would have allowed the firm to leverage digital marketing opportunities.

3.3 Things to Continue Working on in My Next Position

In my upcoming roles, I plan to focus on several key areas that were both challenging and rewarding during my internship. First, I aim to continue developing my skills in digital

marketing, particularly in content strategy, Paid Ads, SEO, and social media management. These areas are critical for building a strong online presence. I intend to deepen my expertise to drive more significant results. Additionally, I want to improve my project management skills, ensuring that I can handle multiple tasks effectively even when working independently. Another priority is to refine my ability to work with limited resources. My experience at Nawaz Nahid Consulting taught me the importance of creativity and resourcefulness in achieving high-quality outcomes. I also plan to enhance my communication skills, particularly in simplifying complex ideas and presenting them clearly to diverse audiences. This will be crucial in my future roles, where clear and effective communication is key to successful collaboration and client engagement.

3.4 Recommendations for Improving the Internship Program

1. **Structured Training and Onboarding:** To optimize the internship experience, I recommend implementing a more structured onboarding process. This could include a series of initial training sessions covering the firm's tools, methodologies, and expectations. This will provide a clear roadmap to help new interns understand their roles more quickly and begin contributing effectively from the start.
2. **Collaborative Projects:** Introducing project-based assignments with clear objectives and deadlines would greatly benefit both the intern and the firm. Assigning interns to specific projects and providing them with a small team or a mentor could enhance their learning experience and productivity. This approach would also foster a collaborative spirit, allowing interns to gain insights from different perspectives and contribute more meaningfully to the firm's goals.
3. **Provide Equipment and Resources:** Investing in better marketing tools and equipment, particularly for video production would significantly improve the quality of content produced. A basic in-house production setup would allow interns to create professional-grade materials that can effectively promote the firm's services. This would not only enhance the intern's experience but also contribute to the firm's long-term digital marketing efforts.
4. **Regular Feedback and Check-ins:** Establishing a routine for regular feedback sessions would provide interns with the guidance they need to refine their work and stay aligned with the firm's objectives. These sessions could be used to discuss progress, challenges, and any additional support the intern might need. Regular check-ins would also allow interns to voice their ideas and concerns which will ensure a more engaged and productive experience.

By implementing these recommendations, Nawaz Nahid Consulting can significantly enhance its internship program, making it more structured, supportive, and enriching for future interns. This will not only attract top talent but also ensure that interns are well-prepared to make meaningful contributions to the firm's success.

Chapter Four: Personal Development Plan

4.1 Next Course of Action and Career Plan

As I move forward in my career, my immediate goal is to build or update my portfolio highlighting the things I have applied in the real world as I am confident in those. My next step is to secure a position within a marketing department where I can continue to develop my skills in digital marketing, content strategy, SEO, Data Analytics, and more. I plan to take more diversity which requires strategic thinking and innovative solutions to earn the experience.

In the long term, I aspire to become a digital marketing strategist, specializing in creating and executing comprehensive campaigns that drive business growth. To achieve this, I intend to pursue additional certifications in areas like digital marketing, video production, data analytics, and AI-driven marketing automation. A master's degree in marketing may also be part of my future educational journey to deepen my expertise and keep pace with industry developments. I also aim to gain experience across different industries to broaden my understanding of how marketing strategies can be tailored to meet unique business needs.

4.2 Technical and Interpersonal Skills to Develop

Technical Skills:

To advance in my career and secure employment, I recognize the need to develop several critical technical skills:

1. **Advanced SEO Techniques:** I plan to deepen my expertise in SEO, particularly in areas like technical SEO, advanced keyword research, and link-building strategies. However, a big problem in the SEO field is the question of its existence in the age of AI search. Therefore, I cannot master the existence of one line of mastery in these areas, which will enhance my ability to increase website visibility and drive targeted traffic.
2. **Data Analytics:** Understanding and effectively using data is crucial in digital marketing. I experienced this when I did competitive research and collected data. I used AI for briefing and explanation, however, I believe learning data analytics will help me consider more aspects. I aim to become proficient in tools like Google Analytics, SEMrush, and Tableau to make data-driven decisions and optimize campaigns for better results.
3. **AI-Driven Marketing Automation and Prompt Engineering:** With the rise of AI in marketing, I plan to take courses focused on AI development and marketing automation tools. For example, I want to create AI-like data-scraping automation that fits my preferences. In my internship, I experienced difficulty creating good content with the right tone, easy writing, and understanding language. This will help me streamline marketing processes, improve efficiency, and deliver personalized content at scale.
4. **Project Management Tools:** As I take on more complex projects, I want to become skilled in using project management tools like Asana, Trello, or ClickUp. These tools will help me manage tasks effectively, collaborate with teams, and ensure projects are completed on time and within budget.

Interpersonal Skills:

1. **Effective Communication:** I want to improve my ability to communicate complex ideas clearly and persuasively, whether in writing or face-to-face. This skill is crucial since most of my decisions involve coordination with other departments. Effective communication is also key when presenting strategies to stakeholders and ensuring productive collaboration with team members, thereby facilitating organizational success.
2. **Leadership and Team Collaboration:** As I advance in my career, developing leadership skills will become increasingly important. I'm focused on learning how to lead teams, motivate colleagues, and positively handle conflicts. Improving the ability to engage in active listening, provide constructive feedback, and foster a collaborative work environment is integral to effective leadership, particularly in complex and dynamic professional settings.
3. **Networking:** Building strong professional relationships is vital for career development. I plan to actively participate in industry events, join professional associations, and seek mentorship opportunities as strategies to expand one's professional network. Growing my network will not only provide valuable insights but also open up new opportunities for growth and learning.

In conclusion, my personal development plan will be more flexible as the AI revolution is happening. I want to build an automation tool that will do all the work from creating optimized campaigns to interpreting the best results. Besides, I believe that focusing on small businesses can be a great opportunity because most of the time they fail to get hands-on people who could actually help them. The reason is that most candidates apply for big desk jobs and often get rejected, however, if they had started in small businesses, they could have derived some good margins. Therefore, my simple agenda is to help businesses rather, continue learning with them, rather than bouncing on interview chairs.

Part B

Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption

Abstract

This study addresses the critical challenge faced by executives in determining the optimal timing for adopting emerging technologies. Building upon existing technology adoption models, we propose a novel framework to guide decision-makers in assessing when to embrace new technologies and what approach to take. The research synthesizes insights from established models such as the S-Curve Model, Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Technology-Organization-Environment (TOE) framework, and Diffusion of Innovation (DOI) theory. Through a comprehensive literature review and analysis of early and late technology adoption case studies, we developed a decision-making framework that considers both internal organizational factors and external market conditions. Subsequently, a survey questionnaire and in-depth interviews were conducted in various industries in Bangladesh to assess the proposed model and establish evidence of its validity and reliability. The proposed model aims to mitigate the risks associated with premature adoption or delayed implementation of emerging technologies. By following the proposed decision framework, organizations can make timely strategic decisions when adopting emerging technologies.

Keywords: Emerging technology, TAM, UTAUT, TOE, Optimal Timing, Adoption, Model

Introduction

In the current fast-paced technological landscape, business leaders are increasingly challenged with determining the right moment to adopt new technologies. Mistimed adoption can result in significant financial setbacks or missed opportunities which can eventually pose critical risks for organizations. For instance, Google Glass and EV1 faced significant hurdles because their technology was ahead of its time, and societal acceptance and market readiness were lacking, leading to their downfall (Kim, 2023). Conversely, companies like Blockbuster and Kodak have become synonymous with the perils of delayed adaptation to emerging technologies that ultimately lead to their downfall in the face of digital disruption (Lucas & Goh, 2009). The dilemma is aptly captured by the persistent questions plaguing business leaders: "Are we moving too early?" or "Are we already too late?" These historical examples highlight the importance of timing in technology adoption.

This challenge persists as businesses, now confront a new wave of emerging technologies, including artificial intelligence (AI), blockchain, Internet of Things (IoT), and big data analytics. McKinsey & Company (2023) states the complexities and uncertainties surrounding adopting emerging technologies such as AI, IoT, and automation have both transformative potential and the risks involved.

Problem Statement

While existing models such as the Technology Acceptance Model (TAM) (Davis, 1989), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990), and Diffusion of Innovation (DOI) theory (Rogers, 2003) provide valuable insights into technology adoption, they do not explicitly address the crucial question of timing. These models focus primarily on factors influencing adoption decisions but offer limited guidance on when to implement these decisions.

This research aims to bridge this critical gap by developing a comprehensive framework that guides executives in determining the optimal timing for emerging technology adoption and guiding them taking strategic actions. By integrating elements from established models and incorporating new factors specific to timing decisions from case studies, we aim to provide a practical tool for strategic decision-making in technology adoption.

Research Objectives:

The primary objectives of this study are:

1. To analyze the limitations of existing technology adoption models in addressing the timing of adoption.
2. To identify key factors that influence the optimal timing for emerging technology adoption through a comprehensive literature review and case study analysis.

3. To develop a novel framework which synthesizes the key factors and provides actionable guidance for executives facing adoption timing decisions.
4. To validate the proposed framework through expert interviews and surveys.
5. To provide strategic recommendations based on the TAT Model to help organizations mitigate risks associated with premature or delayed technology adoption while optimizing their overall business performance.

Literature Review:

Technological disruptions have affected various industries, ranging from telecommunications to healthcare. Emerging technologies like artificial intelligence (AI), blockchain, Internet of Things (IoT), and big data analytics have revolutionized business models, but their adoption has become a perennial challenge for executives in deciding how and when to respond to these emerging technologies. It is very easy for firms to get such decisions wrong because of the inherent uncertainty around any emerging technology, for example, in terms of how quickly it is developing, how it might be commercialized, and its impact on existing products (Birkinshaw, 2023).

Bangladesh is not indifferent, emerging technologies such as AI, blockchain, IoT, and mobile applications are transforming industries like finance, logistics, manufacturing, and healthcare. For instance, IPDC Finance introducing Blockchain, Nagad and BRAC Bank leveraging AI for customer service and fraud detection, while eCourier and Pathao utilize IoT for real-time tracking and route optimization in logistics. The RMG sector, led by BGMEA and Epyllion Group, incorporates IoT and AI to enhance production efficiency and quality control. In healthcare, Beximco and Incepta Pharmaceuticals utilize AI and biotechnology for drug discovery and vaccine development. The list continues even lengthier than we might expect.

This literature review consists of two things: 1) analyzing the existing models, and finding their limitations; and 2) analysis of key case studies in early and late technology adoption, their market impact, and factors we can learn from them

N.B: The only purpose of including this literature review beyond the guideline, is to give the reader a wider understanding of the proposed model necessity and development.

After doing an exhaustive literature review of the existing models, here are the main findings with limitations presented below in the table:

Table 1: Analysis of existing models

Model/Theory	Key Concepts	Focus	Limitations
Technology S-curve Model Foster (1986);	Lifecycle of technology adoption, S-shaped diffusion curve, adopter	Technology evolution and adoption timing	Focuses primarily on technology evolution; less emphasis on

	categories (Innovators, Early Adopters, Early Majority, Late Majority, Laggards)		organizational/environmental factors (Christensen, 1997).
Technology Acceptance Model (TAM)	Perceived Usefulness (PU), Perceived Ease of Use (PEOU)	Individual-level technology adoption	primarily focused on individual-level adoption and does not account for organizational factors or the timing of adoption within an organization (Lee, Kozar, & Larsen, 2003)
Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions	Individual-level technology adoption	Does not address timing of organizational adoption decisions (Newcastle University, n.d.)
Technology-Organization-Environment (TOE) Framework	Technological context, Organizational context, Environmental context	Organizational-level adoption factors	Lacks guidance on how factors influence the timing of adoption decisions (Newcastle University, n.d.)
Diffusion of Innovation (DOI) Theory	Adopter categories (Innovators, Early Adopters, Early Majority, Late Majority, Laggards), diffusion process	Spread of innovations over time	Focuses more on individual/social aspects; less on organizational strategies and timing (Newcastle University, n.d.)

The tables presented below serve as a structured analysis of key case studies in early and late technology adoption which provide a clear comparison of how different companies from different industries navigated the challenges of introducing or adapting to new technologies.

These tables were created to offer a concise yet comprehensive overview of the factors influencing the success or failure of these companies in their respective markets.

Each case study sheds light on specific factors—such as technological readiness, market dynamics, environment, and competitive actions—that significantly affect the adoption process. These factors are central to the development of the Technology Adoption Timing Model.

Table 2: Case Studies of Early Adoption

Product/ Company	Product Description and Industry Overview	Impact on Sales and Market Share	Competitors' Actions and Impact	Analysis and Learning Factors
Google Glass	Product Description: Launched in 2013, Google Glass was a wearable device integrating augmented reality. Industry Overview: At the time, the wearable tech market was new, with high interest but uncertain demand.	Sold only around 150,000 units; discontinued in 2015 with an estimated loss of \$895 million (Weidner, 2024)).	Apple delayed its entry into smart glasses, focusing on the Apple Watch, which generated \$30 billion in revenue by 2019 (Buchholz, 2021)	Factors Identified: Privacy concerns, social acceptance, technological and market readiness. Decision Factors: Premature market entry. Learning Factors: Address privacy and social concerns; wait for technology and market to mature (Hong & Thong, 2013).
General Motors EV1	Product Description: The EV1, introduced in 1996, was GM's first mass-produced electric vehicle. Industry Overview: The auto industry was dominated by gasoline engines, with minimal infrastructure for EVs.	Produced around 1,100 units; terminated in 2003 with a \$1 billion loss (Edwards, 2006).	Tesla entered later, focusing on battery technology and infrastructure, leading to a market cap of over \$800 billion by 2020 (StatMuse, 2020).	Factors Identified: Technological readiness, infrastructure. Decision Factors: Insufficient infrastructure and immature technology. Learning Factors: Assess infrastructure and technology readiness before market entry (Fujitsu, 2015)
Palm Pilot	Product Description: Launched in 1996, the Palm Pilot was an early PDA offering mobile computing. Industry	Initially successful but couldn't compete with smartphones; acquired by HP for \$1.2 billion in 2010 (Vance	Apple's iPhone revolutionized the market, capturing over 20% market share by 2010	Factors Identified: Technological evolution, market readiness. Decision Factors: Failure to innovate. Learning Factors:

	Overview: The mid-1990s saw rising interest in portable digital devices, with smartphones still in development.	& Wortham, 2010).	(Laricchia, 2024).	Continuously innovate and adapt to emerging technologies (Porter, 1985).
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Table 3: Case Studies of Late Adoption

Product/ Company	Product Description and Industry Overview	Impact on Sales and Market Share	Competitors' Actions and Impact	Analysis and Learning Factors
Nokia	Product Description: Nokia was a leader in mobile phones but slow to enter the smartphone market. Industry Overview: Early 2000s saw a shift to smartphones, driven by mobile internet and apps.	Lost market share, acquired by Microsoft for \$7.2 billion in 2014. (BBC News, 2013)	Apple and Samsung dominated with innovative smartphones, with Apple earning \$137 billion in revenue from iPhone sales in 2020 (Statista, 2021).	Factors Identified: Technological innovation, market readiness. Decision Factors: Delayed entry into smartphones. Learning Factors: Innovate continuously to maintain leadership
Blockbuster	Product Description: Blockbuster was a dominant video rental service in the 1990s. Industry Overview: The early 2000s saw the rise of digital streaming, which began to disrupt traditional media.	Declined due to digital streaming; filed for bankruptcy in 2010 with nearly \$1 billion in debt (Satell, 2014).	Netflix pivoted to online streaming, achieving over 200 million subscribers by 2020 (Stoll, 2024).	Factors Identified: Market readiness, technological advancements. Decision Factors: Failed to recognize digital disruption. Learning Factors: Stay vigilant of market trends and adopt disruptive technologies promptly (Teece, Peteraf, & Leih, 2016).
Kodak	Product Description:	Late adoption of digital	In 2010, Canon held a	Factors Identified: Technological

	Kodak was a major player in film photography but slow to adopt digital. Industry Overview: The late 1990s and early 2000s marked a shift to digital photography, which Kodak hesitated to embrace.	photography led to bankruptcy in 2012; revenue dropped from \$16 billion in 1996 to \$6.2 billion in 2011 (The Economist, 2012).	19% market share and Nikon held a 12.6% share in the digital camera market, while Sony accounted for 17.9% (PetaPixel, 2011)	readiness, market trends. Decision Factors: Slow strategic pivot. Learning Factors: Embrace new technologies promptly (Tripsas & Gavetti, 2000).
Grameen-phone	Product Description: Grameenphone, a top telecom provider in Bangladesh, was slow in launching 4G services. Industry Overview: The telecom industry in Bangladesh was rapidly evolving with the introduction of 4G technology.	Delayed 4G rollout; market share dropped from 46% in 2017 to 40% in 2019 (The Daily Star, 2019).	Robi's market share increased to 29.6% by the end of 2019, (The Daily Star, 2020)	Factors Identified: Technological and market readiness, infrastructure. Decision Factors: Delayed technology rollout. Learning Factors: Research indicates that early adoption of new technologies can significantly enhance competitive positioning (Lumenalta, 2024).
Yahoo Search Engine	Product Description: Yahoo was a leading internet portal and search engine in the 1990s but failed to innovate. Industry Overview: The search engine market became highly competitive in the early 2000s, with Google	Lost market share to Google; revenue dropped from \$7 billion in 2008 to \$5 billion in 2016 (Thomas, 2016)	Google dominated with innovation and strategic acquisitions, reaching \$162 billion in ad revenue by 2019 (Alphabet, 2020)	Factors Identified: Technological innovation, market readiness. Decision Factors: Failed to innovate and adapt. Learning Factors: Innovate continuously to maintain competitiveness.

	emerging as a leader.			
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Table 3: Final Key Components/Factors of the Proposed Model

In Appendix C, the explanation for choosing these factors is well-described.

Key Component	Sub-Factors	Description
Technology Readiness (TR)	Maturity of the Technology	Assesses the development stage and reliability of the technology, including its stability, performance, and proof of concept.
	Scalability and Integration Potential	Evaluates the capability of the technology to expand and integrate seamlessly with existing systems of the organization.
	Innovation Rate	Tracks the speed at which the technology is evolving and advancing.
Organizational Context (OC)	Resource Availability	Reviews the availability and allocation of resources necessary for successful technology adoption.
	Strategic Alignment with Business Goals	Ensures that the technology adoption aligns with the organization's objectives and long-term strategic goals.
	Organizational Culture and Change Readiness	Examines the organization's culture and its preparedness to embrace new technologies and changes.
	Technical Support and Training	Assesses the availability of technical support and the necessary training for users to effectively adopt the technology.
Environmental Context (EC)	Regulatory Requirements	Evaluates compliance with relevant laws, regulations, and industry standards.
	Supporting Infrastructure	Reviews the necessary physical and Environmental structures that must be in place to support the technology.
	Societal Acceptance	Measures public perception and the general acceptance of the technology by society.
Market Dynamics (MD)	Customer Demand and Readiness	Assesses the market demand for the technology and the readiness of customers to adopt it.
	Competitive Landscape	Examines the actions of competitors and the overall competitive environment in the market.

	Industry Trends and Disruption Potential	Monitors trends within the industry and evaluates the potential for technological disruptions.
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After deciding the factors, it's time to develop the proposed model and ensure its validity and reliability.

The Technology Adoption Timing (TAT) Model

1. Framework Overview

The Technology Adoption Timing (TAT) Model is a strategic tool designed to assist organizations in determining the optimal timing for adopting emerging technologies and providing actionable strategic guidelines. The model considers various critical factors, such as technology readiness, organizational context, market dynamics, and environmental context. Through systematic evaluation of these factors, the TAT Model helps executives make informed decisions that maximize the benefits of adopting new technologies while minimizing associated risks and potential disruptions.

2. Key components

Key Component	Sub-Factors
Technology Readiness (TR)	1. Maturity of the Technology; 2. Scalability and Integration Potential; 3. Innovation Rate;
Organizational Context (OC)	1. Resource Availability; 2. Strategic Alignment with Business Goals; 3. Organizational Culture and Change Readiness; 4. Technical Support and Training
Environmental Context (EC)	1. Regulatory Requirements; 2. Supporting Infrastructure; 3. Societal Acceptance
Market Dynamics (MD)	1. Customer Demand and Readiness; 2. Competitive Landscape; 3. Industry Trends and Disruption Potential

3. Assessment Process

Step 1: Evaluate Each Component on a Scale of 1-5

- 1 = Very Low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very High
- Compute the average score for each key component by considering its sub-factors.

Step 2: Apply Importance Weightings to Each Component

- **Adjust weightings based on industry and specific technology needs.** The accuracy of the Technology Adoption Readiness Score (TARS) in the TAT Model relies heavily on the appropriate assignment of weights to each factor. These weights are not universal but should be customized to reflect the specific context of the organization and its industry. For example, one organization might have the resources and skills needed to adapt the emerging technology, in such cases, the Organizational Context would be

assigned higher weights within the model, as the company's internal readiness, and resource allocation, would be key factors in determining the optimal timing for technology adoption.

In Appendix D, a note has been attached for more clarification about adjusting the weights.

Step 3: Calculate the Technology Adoption Readiness Score (TARS)

- **TARS Calculation:** $TARS = (TR * Weight) + (OC * Weight) + (EC * Weight) + (MD * Weight)$

Step 4: Interpret the TARS

- **TARS < 2.5:** Early stage - Monitor and prepare
- **$2.5 \leq TARS < 3.5$:** Emerging opportunity - Consider pilot projects
- **$3.5 \leq TARS < 4.5$:** Prime adoption window - Implement strategically
- **TARS ≥ 4.5 :** Mature technology - Accelerate adoption to catch up

Step 5: Make strategic actions

Based on the interpretation of the TARS score, a table with actionable strategic actions is given in Appendix E.

Methodology

Type of Research

The research conducted during my internship was primarily exploratory in nature and focused on various industries. Exploratory research is typically employed when there is limited prior knowledge or when the goal is to explore a new concept. In this case, the study sought to validate the TAT Model for assessing its effectiveness and adaptability in real-world scenarios. By collecting data from various organizations across Bangladesh, the research provided valuable insights into how the model could be refined and tailored to fit different organizational structures and market conditions. The flexibility of the exploratory approach allowed for a thorough investigation of the model's potential across diverse sectors.

Research Design

The research employed a mixed-method design, combining both qualitative and quantitative approaches to gain a holistic understanding of the TAT model's applicability. The qualitative component is exploratory as this utilizes in-depth case studies and semi-structured interviews with industry experts to understand the underlying factors influencing adoption decisions.

The quantitative aspect involved the distribution of a structured survey through Google Forms to gather data from a sample of respondents. This approach allowed for the collection of measurable data that could be analyzed statistically to assess the model's validity.

In Appendix I, the survey questionnaire is attached to ensure the reliability of the possible answers.

Sampling, Data Collection, and Analysis

Sampling:

The sampling strategy was both purposive and convenience-based. A target sample size of 60 respondents was identified mainly focusing on professionals involved in technology adoption decisions within their organizations across industries. However, due to external factors, including the ongoing crisis in the country, the final sample comprised 38 respondents.

Despite the reduced sample size, the responses were diverse and provided valuable insights into the effectiveness of the TAT model.

Data Collection:

Data collection was conducted using Google Forms for the quantitative survey, which allowed for efficient and widespread distribution. Additionally, qualitative data was gathered through interviews with selected respondents. In cases where respondents were unable to complete the forms independently, I conducted interviews and filled out the forms on their behalf. This dual approach ensured a higher response rate and enriched the data collected.

Data Analysis

For the quantitative data analysis, Standard Deviation and correlation analysis were used to identify and quantify the relationships between various variables within the TAT model. Correlation analysis was instrumental in determining the strength and direction of relationships among key factors, such as technology readiness, market dynamics, and organizational context.

Findings and Discussion

Descriptive statistics were employed to summarize the survey data to get insights into the factors deemed most important in technology adoption. The mean indicated the average importance assigned to each factor, while the standard deviation highlighted the level of agreement or variability among the respondents.

Please view Appendix F, to see the descriptive statistics table.

Findings:

1. **High Importance Factors:** Technical Support and Training (Mean: 4.76) and Scalability and Integration Potential (Mean: 4.66) are rated highest which indicates that these are critical for successful technology adoption.
2. **Moderate Importance Factors:** Competitive landscape (Mean: 4.32) and Societal Acceptance (Mean: 4.34) are slightly less critical but still significant as the importance of external factors in the adoption process.
3. **Response Variability:** Higher variability in factors like Industry Trends and Disruption Potential (Standard Deviation: 0.78) suggests differing views across respondents. That is likely due to industry-specific considerations.

Pearson Correlation Coefficients were calculated to measure the strength and direction of the linear relationships between factors. The coefficient ranges from -1 to 1. **1** indicates a perfect positive linear relationship; **-1** indicates a perfect negative linear relationship; **0** indicates no linear relationship.

In Appendix G and Appendix H, the correlation analysis table and Correlation Matrix Heatmap are provided to give an in-depth perspective.

- **Resource Availability and Technology Maturity:** A strong correlation (0.81) between technology maturity and resource availability suggests that mature technologies often require significant investment in resources, including personnel, finances, and equipment, for successful adoption. **Strategic Implication:** Decision-makers should prioritize resource allocation to ensure that mature technologies, which are highly reliable and developed, receive the necessary support for optimal implementation.
- **Scalability and Regulatory Compliance:** A notable correlation (0.65) between scalability and regulatory requirements shows that scalable technologies, which can grow with the organization, must also align with compliance standards to minimize legal and operational risks. **Strategic Implication:** Organizations should prioritize technologies that are both scalable and meet regulatory requirements, ensuring smoother implementation and adherence to legal standards.
- **Scalability and Supporting Infrastructure:** The strong correlation between scalability and both technical support (0.69) and infrastructure compatibility (0.64) highlights the need for robust supporting systems when implementing scalable

technologies. **Strategic Implication:** When planning for technology scalability, organizations should simultaneously invest in technical support, infrastructure, and training to enable seamless integration and support of new technologies.

- **Innovation as an Independent Factor:** Weaker correlations between innovation and other factors (e.g., 0.49 with infrastructure) suggest that innovation may often be treated as an independent variable within the technology adoption process, as it tends to follow its own pace and dynamics. **Strategic Implication:** Innovation should be pursued as a distinct strategic objective, separate from immediate operational concerns, ensuring that organizations remain ahead of market trends and maintain a competitive edge.

Recommendations:

1. **Adopt a Holistic Approach to Technology Readiness:** Given that all factors—such as Maturity of Technology, and Scalability and Integration Potential were found to have nearly equal significance. Each factor should be given equal consideration during the decision-making process to ensure a well-rounded strategy that addresses all potential challenges and opportunities.
2. **Strengthen Organizational Readiness:** The strong influence of Organizational Culture and Change Readiness highlights the need for fostering a culture that is adaptable and open to change. Investing in change management programs and engaging employees early in the adoption process can significantly increase the likelihood of successful implementation.
3. **Invest in Technical Support and Training:** The analysis underscores the importance of Technical Support and Training in successful technology adoption. Ensure that sufficient resources are allocated to training programs that empower employees to effectively utilize new technologies. Additionally, robust technical support should be available to address any issues that arise during and after the implementation phase.
4. **Monitor and Adapt to Market and Regulatory Changes:** Factors like Competitive Market Landscape and Regulatory Requirements play significant roles in technology adoption. Therefore, continuously monitor the competitive landscape and regulatory environment to stay ahead of potential challenges. Being proactive in adapting to these changes will help your organization maintain a competitive edge and avoid compliance-related risks.
5. **Engage in Continuous Improvement:** Use the insights gained from this model to engage in continuous improvement. Regularly update the TAT model with new data and insights to refine your decision-making process. This dynamic approach will help your organization remain agile and responsive to technological advancements.
6. **Leverage External Expertise:** While the model provides a solid foundation for decision-making, also consider engaging with industry experts or consultants to validate your strategies and gain additional perspectives in determining the weights.
7. **Prioritize Based on Organizational Needs:** While all factors are important, prioritize them based on your organization's specific needs and context. For example, if your organization operates in a highly regulated industry, you might prioritize Regulatory Requirements and Compliance more heavily. This is applicable for other factors as well.

The strategic recommendations based on the TARS score help executives or decision makers about when and what actions to take regarding emerging technologies.

Conclusion:

In today's rapidly evolving technological landscape, organizations must make timely and informed decisions about technology adoption. The validated Technology Adoption Timing (TAT) model provides a strong framework for guiding these decisions. Key factors such as Maturity of Technology, Scalability and Integration Potential, Innovation Rate, Technical Support and Training, Environmental Context, and Strategic Alignment with Business Goals were all found to significantly contribute to adoption readiness.

The TAT model's versatility makes it valuable across industries which will help decision-makers ensure a balanced, strategic approach to technology adoption. Its statistically significant results confirm its reliability in addressing complex challenges.

To maintain competitiveness, organizations should regularly update the model and adapt to changing market and regulatory conditions. By following the recommendations, they can enhance decision-making, reduce risks, and fully realize the benefits of new technologies

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Appendix A
Project Proposal Form

Name:	Emon
ID:	201011014
Semester (Spring/Summer/Fall)	Summer 2024
Department:	Bachelor of Business
Supervisor's Name (Faculty):	Shubhankar Shil
Internship Title:	Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption

 11.06.24

Student's signature & date

 11.06.24

Supervisor's signature & date

LETTER OF TRANSMITTAL

12^h June, 2024

Emon, Cell: +880 18758-16450, Email: emon.bba@ulab.edu.bd

Shubhankar Shil
Assistant Professor
School of Business
University of Liberal Arts Bangladesh (ULAB)
688, Beribadh Road
Mohammadpur, Dhaka 1207.

Dear Sir,

Subject: Submission of Internship Proposal.

Please find attached herewith the proposal for an internship in partial fulfillment of the requirement for a Bachelor's of Business Administration (BBA) at Newaz Nahid Consulting, Niketon, Gulshan-1 from 1st June, 2024.

If you have any questions, please call me at +880 18758-16450, you can reach me most easily at the following times: Available Hours e.g. 8:30 am to 10:00 pm, Workdays e.g. Saturday to Thursday.

Sincerely yours,



Emon

ID: 201011014

BBA Program

School of Business

University of Liberal Arts Bangladesh

Developing the Technology Adoption Timing (TAT) Model: A Framework for Timely Strategic Decision-making in Emerging Technology Adoption

Supervisor: Shubhankar Shil

University of Liberal Arts Bangladesh (ULAB)

An internship Proposal

Submitted in Partial Fulfillment

Of the Requirements for the Degree

Bachelors of Business Administration

By

Emon

ID: 201011014

Summer 2024

11th June, 2024

Description of the Project Study:

An Overview of the Study: In this research, we will analyze the development and validation of the Technology Adoption Timing (TAT) Model, which is aimed at guiding organizations in determining the optimal timing for adopting emerging technologies. The study will cover key factors such as technology readiness, market dynamics, organizational context, environmental factors, and the risk-opportunity balance. These factors will be examined to provide insights into the timing challenges faced by organizations when adopting new technologies like AI, IoT, and blockchain.

Nature of the Study:

Mixed-method research using both descriptive quantitative and qualitative approaches.

The Objectives of the Study:

The objectives of the study are as follows:

To develop and refine the TAT Model, which assists executives in making data-driven decisions regarding the timing of technology adoption.

To validate the TAT Model through a combination of surveys and interviews across multiple industries.

Expected Contribution and Gain:

The study will offer valuable insights into the optimal timing for adopting emerging technologies by using a structured decision-making framework. This research will help organizations minimize the risks of premature or delayed technology adoption and improve their competitive edge, operational efficiency, and innovation strategies. By adopting the TAT Model, organizations will be better equipped to align technology adoption with market readiness and organizational objectives.

Justification of the Study:

This topic is chosen because organizations increasingly face challenges in identifying the right time to adopt emerging technologies and strategic decisions. Many companies risk financial loss or missed opportunities by adopting too early or too late. The TAT Model is designed to address these issues by providing practical guidance to help organizations align their technology adoption strategies with market trends and organizational goals.

Sources and Methods of Collecting Primary Data:

Primary data will be collected through structured surveys and in-depth interviews with decision-makers and industry professionals involved in technology adoption. Surveys will focus on validating the model, while interviews will provide qualitative insights into the practical challenges and successes of technology adoption in different industries.

Sources and Methods of Collecting Secondary Data:

Secondary data will be collected from existing literature, case studies of organizations that have adopted new technologies, industry reports, and relevant publications. These sources will help in building the theoretical foundation and benchmarking the TAT Model.

Sampling Technique and Sample Size:

The total population will include industry professionals and decision-makers from various sectors. The sample size will be approximately 50-60 respondents for the survey and 10-15 participants for the interviews. The purposive sampling technique will be employed to target individuals who have experience and expertise in technology adoption within their organizations across industries.

Analysis and Interpretation of Data:

Firstly, case studies of early adoption and late adoption, and existed models will be thoroughly analyzed to identify the factors associated for the proposed model. Quantitative data from the surveys will be analyzed using statistical methods such as correlation analysis to validate the TAT Model's factors. Qualitative data from interviews will be thematically analyzed to provide deeper insights. Microsoft Excel will be used to create graphs and charts for data representation.

Reporting: A final report will be written at the end of the study with the findings. The academic supervisor and institutional supervisor will be regularly updated on the progress.

Serial	Activity	Weeks											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Consultation with Supervisors	√	√	√	√	√	√	√	√	√	√	√	√
2	Literature review		√	√	√								
3	Secondary Data Collection					√	√	√	√	√	√		
4	Primary Data Collection						√	√					
5	Data Analysis								√	√			
6	Draft Report Writing										√		
7	Final Report Writing											√	
8	Report Submission												√



Emon

ID: 201011014

Appendix: B



**NEWAZ
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TO WHOM IT MAY CONCERN

I have the honor to bring your kind attention that Mr. Emon bearing ID # 201011014 from BBA Program, University of Liberal Arts Bangladesh has started his Internship Program with our organization since June 1, 2024.

I am very pleased to inform you that I, the undersigned, would be his on-site supervisor and I would mentor him to my best possible level so that she would complete her Internship Program duly.

Please feel free to contact me for any further information.

RK 01/06/2024
Sincerely,
Md. Rezaul Karim
Manager – Administration

NNC

Appendix: C

Tables of Factors and Their Relevance to the TAT Model

Factors Chosen for the Proposed Model and Their Importance (from case studies) –

Based on the analysis of the case studies, the following factors are identified as suitable for the proposed model:

Table: Factors Chosen for the Proposed Model and Their Importance (Case Studies)

Factor	Why Chosen	Case Study Example	Importance for TAT Model
Market Dynamics	High frequency (mentioned 7 times); critical for understanding demand and market preparedness.	Blockbuster failed to recognize the shift to digital streaming, leading to its downfall, while Netflix embraced the demand for online streaming.	Ensures technology adoption aligns with market demand, reducing risks associated with premature or delayed adoption. Helps predict consumer behavior and market trends for optimal adoption timing.
Technological Readiness	High frequency (mentioned 5 times); crucial for assessing the maturity and robustness of the technology.	GM's EV1 faced limited success due to inadequate battery technology and insufficient infrastructure.	Ensures technology is fully developed and capable of delivering intended benefits, reducing operational risks and increasing the likelihood of successful implementation.
Environmental Context	Essential for supporting new technologies; includes hardware, software, networks, and organizational structures.	The EV1 electric vehicle's failure was partly due to the lack of sufficient charging infrastructure.	Infrastructure ensures that the necessary support systems are in place for smooth technology adoption and operation, facilitating scalability and long-term success.

Factors Chosen for the Proposed Model and Their Importance (from Models)

Table: Main Factors for Optimal Timing of Technology Adoption (Models)

Factor	Description	Relevant Factors	Model(s)
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Market Timing (MT)	Understanding when the market is likely to adopt a technology	Market Demand, Competitive Landscape, Economic Conditions	S-curve
Technology Evolution (TE)	Recognizing the stages of technology maturity	Technology Maturity, Development Phases, Innovation Rate	S-curve
Facilitating Conditions (FC)	Availability of resources and support	Technical Support, Training, Resource Availability	UTAUT
Technological Context (TC)	Characteristics and capabilities of the technology	Compatibility, Technological Advancements, Scalability	TOE
Organizational Context (OC)	Internal factors like firm size, structure, and resources	Organizational Structure, Resource Allocation, Strategic Alignment	TOE
Environmental Context (EC)	External factors such as industry characteristics and regulatory environment	Industry Standards, Regulatory Requirements, Market Competition	TOE

This table summarizes the main factors identified from the literature review, along with their descriptions, relevant sub-factors, and the models they were derived from.

In the process of refining the Technology Adoption Timing (TAT) Model, certain factors were excluded or merged to create a more streamlined and efficient framework that better serves the needs of decision-makers. The exclusions were made to eliminate redundancy and focus on the most critical aspects of technology adoption. For instance, components like “Alignment with Existing Systems” and “Compatibility” under Technology Readiness were merged, as they essentially address the same concern—ensuring that new technologies integrate smoothly with existing infrastructure. Similarly, elements of “Technological Innovation,” such as “Driving Advancement” and “Innovation Rate,” were integrated to “Technology Readiness” to emphasize the continuous evolution of technology without overcomplicating the model.

Factors that were similar in nature or could be assessed together were combined to simplify the model while maintaining its robustness. For example, in the Organizational Context, “Technical Support” and “Training” were combined into a single sub-factor, reflecting the broader need for user readiness and support. This merging ensures that the model remains comprehensive but not overly complex, making it easier for executives to apply in real-world scenarios.

Appendix D

Note on Weight Determination in the TAT Model

The weights assigned to each factor in the Technology Adoption Readiness Score (TARS) calculation are crucial for accuracy. In the TAT Model, these weights are not fixed constants

but should be tailored to the specific context of the organization and industry. Here's how to determine these weights:

1. **Industry Analysis:** Different industries may prioritize certain factors over others. For instance, in highly regulated sectors like banking, the weight for Environmental Factors (EF) might be higher due to the importance of compliance.
2. **Organizational Strategy:** The weights should reflect the organization's strategic priorities. For example, a company focused on rapid innovation might assign a higher weight to Market Dynamics (MD) to remain competitive.
3. **Expert Input:** Engage with industry experts and senior executives to establish appropriate weights for your sector. Their insights can help ensure the weights are aligned with industry standards and practices.
4. **Benchmarking:** Refer to industry benchmarks or best practices for technology adoption within your sector. This comparison can guide the weighting based on what has proven effective in similar contexts.

Appendix E

Table: Here's the interpretation and recommendations based on TARS presented in a table format:

TARS Range	Interpretation	Recommendations
TARS < 2.5	Early Stage – Monitor and Prepare	1. Market Research: Monitor technological advancements and trends. 2. Internal Readiness: Prepare infrastructure and develop necessary skills. 3. Partnership Building: Build relationships with technology providers. 4. Regulatory Engagement: Engage with regulators for compliance preparation. 5. Risk Assessment: Identify vulnerabilities and develop mitigation strategies.
2.5 ≤ TARS < 3.5	Emerging Opportunity – Consider Pilot Projects	1. Pilot Project: Implement a small-scale pilot. 2. Skill Development: Invest in training for expertise. 3. Regulatory Engagement: Stay ahead of compliance requirements. 4. Partnership Exploration: Seek partnerships to address challenges. 5. Phased Approach: Start with low-risk, high-potential cases. 6. Continuous Monitoring: Reassess TARS as technology and regulations evolve. 7. Risk Mitigation: Develop a comprehensive risk management strategy. 8. Competitive Analysis: Monitor competitors' initiatives.
3.5 ≤ TARS < 4.5	Prime Adoption Window –	1. Strategic Implementation: Develop and execute a detailed plan. 2. Scalability Planning: Ensure infrastructure and processes support widespread adoption.

	Implement Strategically	3. Change Management: Implement a robust strategy for smooth transitions. 4. Integration Strategy: Ensure seamless integration with existing systems. 5. Continuous Improvement: Establish mechanisms for ongoing monitoring and improvement. 6. Customer Engagement: Gather feedback and enhance adoption experience. 7. Regulatory Compliance: Ensure ongoing compliance with regulations. 8. Market Expansion: Explore new markets or customer segments.
TARS ≥ 4.5	Mature Technology – Accelerate Adoption to Catch Up	1. Rapid Deployment: Accelerate technology deployment across the organization. 2. Resource Allocation: Allocate resources to support rapid adoption. 3. Innovation Leadership: Position the organization as a leader in adoption through marketing and thought leadership. 4. Performance Optimization: Continuously optimize technology performance and efficiency. 5. Expansion Plans: Expand technology application to other business areas. 6. Competitive Benchmarking: Regularly benchmark against competitors. 7. Customer Integration: Integrate customer feedback into ongoing development. 8. Future-proofing: Invest in R&D to stay ahead of advancements.

This table provides a concise summary of the interpretation and strategic recommendations based on the TARS for organizations considering technology adoption.

Appendix F

Findings and Discussion

Table: Descriptive Statistics:

Factor	Mean Rating (out of 5)	Standard Deviation
Technological Readiness		
Maturity of Technology	4.51	0.71
Scalability and Integration Potential	4.66	0.72
Innovation Rate	4.34	0.71
Organizational Context		
Resource Availability and Allocation	4.69	0.62
Strategic Alignment with Business Goals	4.57	0.62

Organizational Culture and Change Readiness	4.68	0.66
Technical Support and Training	4.76	0.57
Environmental Context		
Regulatory Requirements	4.66	0.65
Supporting Infrastructure	4.55	0.58
Societal Acceptance	4.34	0.73
Market Dynamics		
Customer Demand and Readiness	4.45	0.69
Competitive Landscape	4.32	0.72
Industry Trends and Disruption Potential	4.32	0.78

How the Calculations Were Performed:

- **Mean:** The average score was calculated by summing all the responses for each factor and dividing by the number of respondents.
- **Standard Deviation:** This was calculated to understand the spread of responses around the mean, indicating how much consensus or disagreement exists among respondents.
- **Data Source:** The data was derived from a survey where respondents rated the importance of various factors on a scale of 1 to 5.

Appendix G

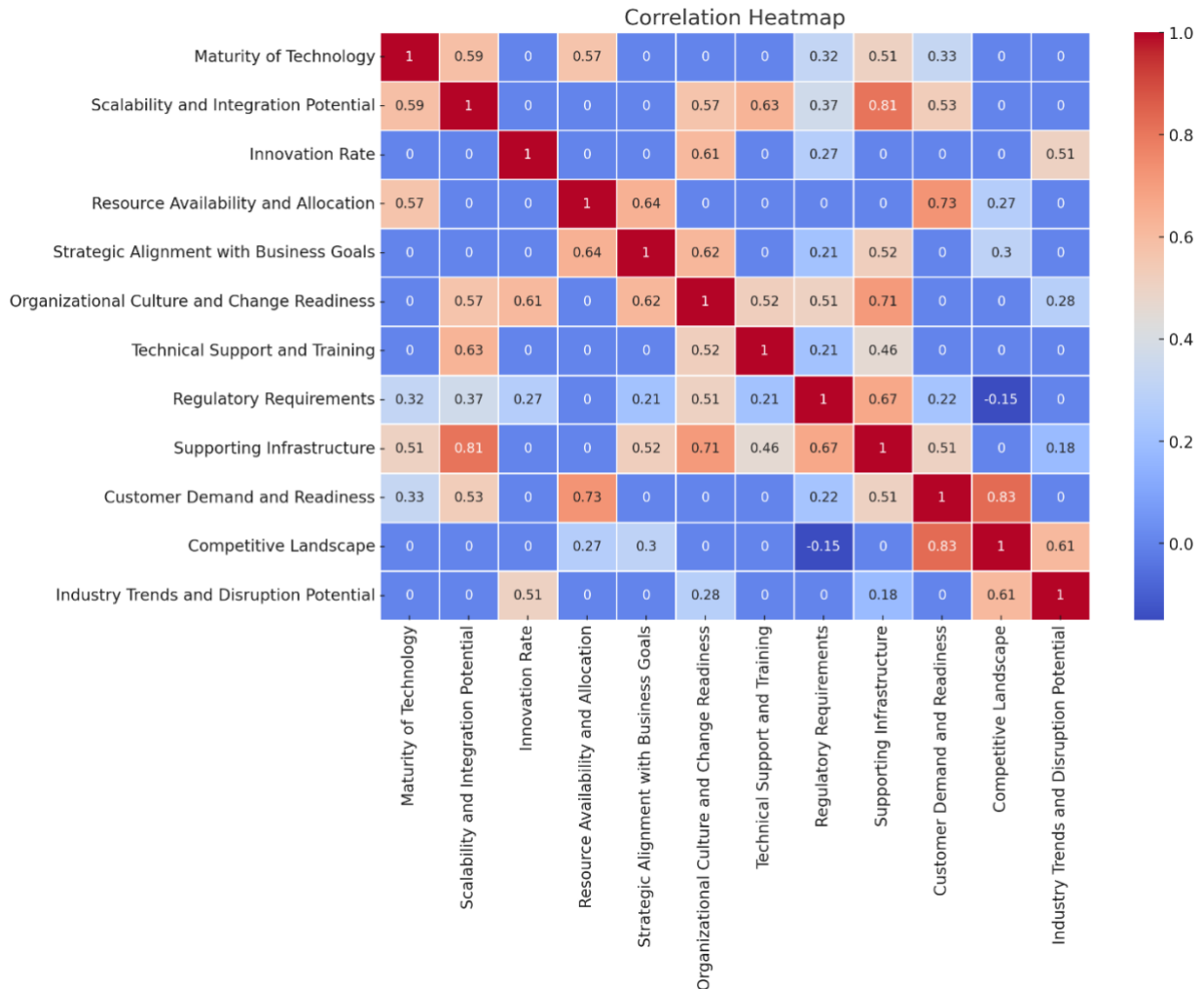
Table: Correlation Analysis

Factor	Strong Correlations	Moderate Correlations	Weak/No Correlations
Maturity of Technology	Scalability and Integration Potential (0.59)	Supporting Infrastructure (0.51)	Regulatory Requirements (0.32), Customer Demand (0.33)
Scalability and Integration Potential	Supporting Infrastructure (0.81)	Maturity of Technology (0.59), Customer Demand (0.53)	Societal Acceptance (0.36), Regulatory Requirements (0.37)
Innovation Rate	N/A	Organizational Culture and Change Readiness (0.61), Industry Trends (0.51)	Regulatory Requirements (0.27), Societal Acceptance (0.26)

Resource Availability and Allocation	Customer Demand (0.73)	Strategic Alignment (0.64), Maturity of Technology (0.57)	Competitive Landscape (0.27), Societal Acceptance (0.29)
Strategic Alignment with Business Goals	N/A	Organizational Culture (0.62), Supporting Infrastructure (0.52)	Regulatory Requirements (0.21), Competitive Landscape (0.30)
Organizational Culture and Change Readiness	Supporting Infrastructure (0.71)	Innovation Rate (0.61), Scalability and Integration Potential (0.57)	Industry Trends (0.28), Customer Demand (0.25)
Technical Support and Training	Scalability and Integration Potential (0.63)	Organizational Culture and Change Readiness (0.52), Supporting Infrastructure (0.46)	Regulatory Requirements (0.21), Societal Acceptance (0.23)
Regulatory Requirements	N/A	Supporting Infrastructure (0.67), Organizational Culture and Change Readiness (0.51), Scalability (0.49)	Competitive Landscape (-0.15), Customer Demand (0.22)
Supporting Infrastructure	Customer Demand and Readiness (0.82), Scalability (0.81)	Technical Support and Training (0.46), Organizational Culture (0.42)	Industry Trends (0.18)
Customer Demand and Readiness	Competitive Landscape (0.83)	Scalability (0.53), Supporting Infrastructure (0.51)	Regulatory Requirements (0.22), Societal Acceptance (0.30)
Competitive Landscape	Customer Demand (0.83)	Industry Trends (0.61), Supporting Infrastructure (0.52)	Regulatory Requirements (-0.15), Maturity of Technology (0.33)
Industry Trends and Disruption Potential	N/A	Competitive Landscape (0.61), Innovation Rate (0.51)	Societal Acceptance (-0.10), Supporting Infrastructure (0.18)

Appendix H

Correlation Matrix Heatmap



The heatmap above visually represents the correlations:

- **Darker Red:** Indicates strong positive correlations between factors.
- **Lighter Red/Orange:** Represents moderate positive correlations.
- **Yellow:** Shows weaker positive correlations.
- **Lighter Blue:** Suggests weak or no correlations between factors.
- **Darker Blue:** Indicates strong negative correlations, though there might not be many negative correlations in this particular analysis.

Appendix I

TAT Validation Questionnaire

Thank you for participating in this survey. We aim to gather insights on the factors influencing the timing of technology adoption within organizations. Your responses will help validate the TAT (Technology Adoption Timing) model, which is designed to assist decision-makers in optimizing their technology adoption strategies.

Confidentiality and Anonymity Your participation is completely anonymous. We do not collect any personally identifiable information, and your responses will be aggregated for analysis. The data collected will be used solely for academic and research purposes.

Instructions

- Please answer all questions honestly and to the best of your ability. If your answer is other, please specify that as well.
- The survey is divided into several sections, focusing on different aspects of technology adoption.
- There are no right or wrong answers; we are interested in your experiences and perspectives.

Thank you for your time and valuable contribution.

Section 1: Demographics

In this section, we ask for basic information about you and your organization. This helps us understand the background and context of your responses. Please be assured that all data is collected anonymously and will be used only in aggregated form.

1. **What is your current job title?** (Do Not Write Student. If you are an Entrepreneur, Please Share That As Well)
☐
2. **How many years of experience do you have in technology-related decision-making roles?**
 - ☐ Less than 5 years
 - ☐ 5-10 years
 - ☐ 11-15 years
 - ☐ 16-20 years
 - ☐ More than 20 years
3. **In which industry does your organization primarily operate?** (Select one)

Column 1	Column 2	Column 3
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☐ Banking and Financial Services	☐ Information Technology	☐ Food and Beverage
☐ Logistics and Supply Chain	☐ Manufacturing	☐ Pharmaceuticals
☐ Fintech	☐ Retail	☐ Government
☐ Ready-Made Garments (RMG)	☐ Consumer Goods	☐ Hospitality and Tourism
☐ Insurance	☐ Energy (Oil & Gas)	☐ Media and Publishing
☐ Healthcare	☐ Automotive	☐ Entertainment
☐ Telecommunications	☐ Education	☐ Agriculture
☐ Construction	☐ Real Estate	☐ Environmental Services
☐ Engineering	☐ Mining	☐ Nonprofit and NGOs
☐ Wholesale and Distribution	☐ Utilities	☐ Legal Services
☐ AI	☐ Other (please specify)	

4. What is the size of your organization in terms of employees?

- ☐ 1-50
- ☐ 51-250
- ☐ 251-1000
- ☐ 1001-5000
- ☐ More than 5000
- ☐ Prefer not to say

Section 2: Technology Adoption Experience

This section aims to gather insights into your organization's experience with adopting new technologies. We are interested in understanding how often your organization considers new technologies, which ones you've considered, and the motivations behind these considerations.

7. How often does your organization consider adopting new technologies?

- ☐ Very frequently (multiple times a year)
- ☐ Frequently (annually)
- ☐ Occasionally (every 2-3 years)
- ☐ Rarely (every 4-5 years or more)
- ☐ Only when absolutely necessary

8. Which emerging technologies has your firm considered adopting in the past 5 years? (Select all that apply)

Column 1	Column 2	Column 3
☐ Artificial Intelligence (AI)	☐ Virtual Reality (VR)	☐ Advanced Materials (e.g., Graphene)
☐ Machine Learning (ML)	☐ Quantum Computing	☐ Biotechnology
☐ Blockchain	☐ Robotics and Automation	☐ Cybersecurity Technologies
☐ Internet of Things (IoT)	☐ Edge Computing	☐ Autonomous Vehicles
☐ 5G Technology	☐ 3D Printing (Additive Manufacturing)	☐ Renewable Energy Technologies (e.g., Solar, Wind)
☐ Augmented Reality (AR)	☐ Advanced Analytics and Big Data	☐ Wearable Technology
☐ Precision Agriculture	☐ Smart Grids	☐ Nanotechnology
☐ Smart Cities Technologies	☐ Fintech Innovations (e.g., Mobile Payments, Cryptocurrencies)	☐ Healthcare Innovations (e.g., Telemedicine, Health Monitoring Devices)
☐ Other (please Specify)		

9. Did your organization ultimately decide to adopt this technology?

- ☐ Yes, we fully adopted it
- ☐ Yes, we implemented a pilot project
- ☐ No, we decided against adoption
- ☐ We are still in the decision-making process

10. What were the primary motivations for considering new technologies? (Select all that apply)

- ☐ Competitive Advantage
- ☐ Regulatory Compliance
- ☐ Customer Demand
- ☐ Operational Efficiency
- ☐ Innovation
- ☐ Other

Section 3: Factors Influencing Technology Adoption (TAT Model Validation)

Here, we explore the various factors that influence the timing of technology adoption in your organization. This section is crucial for validating the TAT model, which seeks to provide a framework for optimal technology adoption timing. Please rate the importance of each factor based on your experience.

Please rate (✓) the importance of each factor on a scale of 1 to 5 where 1 is "Not at all important" and 5 is "Extremely important".

Technology Readiness (TR): *This factor assesses how prepared a technology is for adoption within an organization. It focuses on the maturity, scalability, and compatibility of the technology with existing systems.*

11. Maturity of the Technology: Evaluates how developed and reliable the technology is. It includes stability, performance, and whether there is proof of concept.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

12. Scalability and Integration Potential: Assesses the capability of the technology to grow with your organization and how well it can integrate with existing systems without causing disruptions.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

13. Innovation Rate: Tracks how quickly the technology is evolving and advancing, helping to assess whether the technology will remain relevant in the near future.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

Organizational Context (OC): *This factor considers the internal environment of your organization and how it supports or hinders the adoption of new technology*

14. Resource Availability: Reviews the availability and allocation of resources, such as finances, personnel, and equipment, necessary for successful technology adoption

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

15. Strategic Alignment with Business Goals: Ensures that the technology adoption aligns with your organization's objectives and long-term strategic goals, contributing to overall success.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

16. Organizational Culture and Change Readiness: Examines your organization's culture and its readiness to embrace new technologies and changes, including the willingness of employees to adapt.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

17. Technical Support and Training: Assesses whether adequate technical support and training are available for users to effectively adopt and utilize the new technology.

• Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

Environmental Context (EC): *This factor evaluates external elements that might impact the adoption of technology, such as regulatory requirements, competition, and societal views.*

19. Regulatory Requirements: Evaluates compliance with relevant laws, regulations, and industry standards that govern the use of the technology.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

20. Supporting Infrastructure: Reviews the physical and organizational structures that must be in place to support the technology, ensuring it functions effectively.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

21. Societal Acceptance: Measures public perception and the general acceptance of the technology by society, which can impact its adoption and success.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

Market Dynamics (MD): *This factor examines the market conditions that might influence the timing of technology adoption, such as customer demand and industry trends.*

22. Customer Demand and Readiness: Assesses the market demand for the technology and whether your customers are ready to adopt it. Understanding this helps in timing the adoption when the market is most receptive.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

23. Competitive Landscape: Examines the actions of competitors and the overall competitive environment in the market, helping to identify the right time to adopt new technologies to gain or maintain a competitive edge.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

24. Industry Trends and Disruption Potential: Monitors trends within the industry and evaluates the potential for technological disruptions. Staying ahead of these trends can be crucial for maintaining a competitive advantage.

- Not at all important | 1 | 2 | 3 | 4 | 5 | Extremely important

Section 4: Decision-Making Process

This section delves into how decisions are made regarding technology adoption in your organization. We aim to understand who is involved in these decisions, the approach your organization takes, and the factors that most influence these decisions.

25. How would you describe your firm's approach to adopting new technologies?

- Proactive (early adopter)
- Reactive (wait and see)
- Conservative (late adopter)

- Combination of approaches
- Certainly! Here is the multiple-choice grid question formatted for a printed questionnaire:

26. How often does your organization review and revise its technology adoption strategy?

- Quarterly
- Annually
- Every 2-3 years
- Every 4-5 years or more
- Only when necessary

Section 5: Challenges and Success Factors

In this section, we aim to identify the biggest challenges and key success factors your organization faces when deciding on the timing of technology adoption. Your responses will help us understand common obstacles and strategies for overcoming them.

27. What are the biggest challenges your organization faces when deciding on the timing of technology adoption? (Select all that apply)

- Lack of clear ROI
- Uncertainty about technology maturity
- Organizational resistance to change
- Lack of necessary skills or expertise
- Budget constraints
- Regulatory concerns
- Other

28. Based on your experience, how has the pace of technology adoption in your industry changed over the past 5 years?

- Significantly slower
- Somewhat slower
- About the same
- Somewhat faster
- Significantly faster

29. How do you expect the importance of timing in technology adoption decisions to change in the next 5 years?

- It will become much less important
- It will become somewhat less important
- It will remain about the same
- It will become somewhat more important
- It will become much more important

30. **What additional comments or insights do you have about the challenges and opportunities in adopting emerging technologies in your industry?** [Open-ended response]

Section 6: Framework Evaluation

This section seeks your feedback on the usefulness of a technology adoption timing framework and what specific elements you would like to see included. Your insights will help us refine the TAT model to better meet the needs of organizations like yours.

31. **Are you familiar with any existing frameworks or models for guiding technology adoption decisions?**

- Yes (Please Specify)
- No

32. **How useful do you think a framework specifically addressing the timing of technology adoption would be for your organization? (✓)**

- Not at all useful | 1 | 2 | 3 | 4 | 5 | Extremely important

33. **What additional features or considerations would you like to see included in a technology adoption timing framework and why?** [Open-ended response]