Analysing the Factors Influencing Digital Technology Adoption in Manufacturing Sectors: Leadership Effectiveness as a Mediator

AJAYANDARAN ARUMUGAM
Faculty of Business and Accountancy, Lincoln University College Malaysia,
MALAYSIA

HAMED KHAZAEI
Faculty of Malaysia Japan Institute of Technology,
University Technology Malaysia,
MALAYSIA

AMIYA BHAUMIK
Lincoln University College,
MALAYSIA

THAVAMARAN KANESAN
University of Northumbria,
Newcastle, UK

Abstract: The convergence of emerging technologies and commitments of manufacturing enterprises has formed a trend in reshaping the global manufacturing landscape. Hence, electrical and electronic (E&E) manufacturers should not be expected to 'face it alone' in the current manufacturing environment. Specifically, manufacturing companies will profit from intelligent operational relationships with suppliers and government programmes that promote and support the adoption and usage of advanced development tactics and technology. Thus, the study aims to emphasize the influence of digital technology adoption on the E&E manufacturing industry through the lens of leadership effectiveness. Additionally, the current study focused on identifying and altering the dynamics of new technologies in the E&E manufacturing sector where nations are vigorously competing for advanced manufacturing leadership.

Keywords: Perceived Cost Effectiveness, Digital Technology Adoption, Leadership Effectiveness, Digital Literacy.

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1 Introduction

The convergence of developing technologies and manufacturing could completely transform the global manufacturing scene. Considering the constantly changing global development environment, manufacturing organizations must regularly evaluate their current technologies and practices to remain profitable and competitive, [1]. The study aims to highlight the impact of digital technology adoption in the electrical and electronic (E&E) manufacturing industry through the leadership effectiveness perspective. The introductory chapter explains the current research by establishing a brief history, problem statement, aims, and definitions. Moreover, the current study emphasized recognizing and influencing the dynamics of emerging technologies in the E&E manufacturing sector when nations are vying for advanced manufacturing leadership.

Apart from the rapid development impacting manufacturing and the intelligent revolution, digital transformation is a step towards the integration of digital technology, processes, and human capabilities at multiple levels and functions within an organization, industry, or ecosystem through cultural, organizational, and operational change. The digital transformation utilizes technology to create value for multiple stakeholders (employers, employees, and consumers) to expand and acquire the capacity to respond immediately to changing situations, [2]. Digital transformation concerns technology and disruption and the employees' interests, efficiency, and ability to adapt to the

necessary intelligent use of technology and information.

Although digital transformation is most prominent in the industry, the aspect also affects other organizations, including governments and public and private sector entities that employ emerging technologies to address social issues, such as pollution and ageing populations. Additionally, the digital technology revolution in several countries is attempting to address all spheres of life through a state-wide effort, [3]. Substantial studies have examined the relationship between E&E manufacturing firms and digital technology adoption, but no definitive conclusions were drawn due to a 'black box' effect. Macedo, [4] presented conflicting findings on the elements influencing employee acceptance of digital technologies.

Meanwhile, academics are encouraged to examine the influencing factors that may increase digital technology adoption to investigate the 'black box' of background interactions, [5]. Hence, ensuring that digital technology stimulates and promotes sound business processes is critical. Effective executives are essential to guide E&E manufacturing firms towards digital technology adoption. Much scholarly discussion has been based on leaders' readiness to integrate digital transformation into their firms while encouraging employees to accept the change, which is typically considered a threat to the status quo, [6]. Additionally, past findings have fragmented and dispersed leadership and digitalization contributions, thus creating new obstacles for leaders in organizational operational and management perspectives on digital technology adoption, [7]. Thus, the study aims to examine the relationship between E&E manufacturing and digital technology adoption through the leadership effectiveness perspective and better understand the micro-mechanism factors that most impact digital technology adoption, [8].

2 Literature Review and Hypotheses Development

The numerous functions that companies need to play are underlined by the several theories formed to justify organizational actions in varying situations. Findlay and Thompson, [9] applied the ideas to explore how organizations reacted to digital technology adoption and observed that many studies tend to focus "exclusively on a single disciplinary domain, whether it be organizational behavior, human resource management (HRM), leadership, strategic management, finance and so forth". The study established two mainstream management theories, [the Technology Acceptance Model (TAM) and Diffusion of Innovation (DOI)] to examine how organizations will respond to introducing new technologies in E&E manufacturing firms. The study of DOI and TAM indicates that each theory has a different viewpoint on how different sets of variables will impact firms' digital technology adoption decisions in the manufacturing sector, [10].

The DOI research is understudied, specifically the role of usage and adoption of technically related technology. Technology clusters define the thresholds for technology acceptance, [11]. Innovations that concurrently spread are usually interdependent and should be considered likewise in adoption studies, [11]. The initial technology adoption reduces confusion and improves the opportunity to leverage a digital medium, [11]. New information technologies research examines a specific technology where users do not apply related developments in functionality, [12]. Practically, new technology or content solution, specifically one deemed a desirable substitute, will replace its comparable functionality. Technology clusters impact assumed technical characteristics and technology usage motives, [13]. Meyer 14] stated that DOI research does not usually include innovation clusters as they are more complex to grasp than innovation despite its predictive validity. Thus, a deeper view of a person's actions in technological adoption could be achieved by observing innovators who adopt various innovations and assessing influential leaders' influences.

The sub-section conceptualizes the study variables based on past studies to ensure the current study produces a specific, agreed-upon meaning for the study concept. The study developed 11 hypotheses based on the in-depth literature review to achieve the objectives as follows:

3 The Relationship between Perceived Usefulness and Digital Technology Adoption

Davis, [15] described perceived usefulness as "the subjective possibility of a foreseeable user increasing employees' job performance in an organizational context through the use of a particular application system". The notion defines usability as the main predictor of usefulness and purpose, [16] and an individual's belief that the use

of specific digital technology could enhance work productivity, [17]. The importance of perceived utility in technology has long been recognized, [18], where technology could transform the way a person works, which is a beneficial development. Many studies demonstrate that perceived utility impacts intentions to adopt emerging technology, [10], [20]. Navimipour and Soltani, [21], mentioned the perceived benefit of new technology as a critical factor determining adaptation. Hence, the more advantageous an organization perceives a new technology to be, the more likely the new technology will be implemented. The current study examined the direct relationship between perceived usefulness and digital technology adoption, hence presenting the following:

***H_1*:** There is a significant relationship between perceived usefulness and digital technology adoption.

4 The Relationship between Perceived Ease of Use and Digital Technology Adoption

The term 'perceived ease of use' refers to the "degree to which an individual is free of physical and mental effort when utilizing a specific technology", [20]. Studies revealed that perceived ease of use ensures that an individual agrees that utilizing a complex instrument will be accessible to that individual, [20], [21]. Wingo et al., [22] identified a similar link between perceived ease of use and employees' capacity to understand developing technology immediately. Additionally, the elements that increase digital activities include perceived ease of use, which combines simplicity with simple internet connectivity, the availability of secure and high-quality electronic equipment, and the requirement for organizational resources. Extensive studies over the past decade highlighted the direct and indirect crucial impact of perceived ease of use on the intention to use, [23]. Thus, the study investigated the direct relationship between perceived ease of use and acceptance of emerging technology through the following hypothesis:

***H_2*:** There is a significant relationship between perceived ease of use and digital technology adoption.

5 The Relationship between Perceived Cost Effectiveness and Digital Technology Adoption

Dale and Plunkett, [24] defined cost-effectiveness as the extent to which a person believes that using a given item would be more expensive. Critical cost-saving measures include the involvement in large-scale digital technology initiatives or information technology infrastructure establishment in the hardware and software sectors. During the early stages of new technology adoption, the perceived value of developing breakthroughs is gradually considered while business investment strategies are being developed, [25]. Businesses often struggle to appropriately incorporate developing technology due to insufficient funds and local competence, [26]. Corporations can eliminate wasteful spending and reallocate funds to more valuable business activities by understanding hidden infrastructure costs.

Businesses should perform a cost-benefit analysis to determine cost-effectiveness by weighing the expenses of introducing new technologies, procedures, or policies against the realized benefits, [27]. Generally, a cost-benefit analysis considers the monetary costs and future gains linked with new technology adoption. Nevertheless, cost-benefit analyses could create potential risks connected with new technology implementation that threaten workers or form non-monetary benefits. Thus, the study examined the direct relationship between perceived cost-effectiveness and technology adoption, therefore forming the hypothesis as follows:

***H_3*:** There is a significant relationship between perceived cost-effectiveness and digital technology adoption.

6 The Relationship between Perceived Effective Communication and Digital Technology Adoption

Persuading people to adopt a new technology perspective from the top down is critical for any organization and the most complex element. The bureaucratic procedures are ingrained in the culture and employees might be notoriously resistant to change, which is a situation recognized by business owners [28]. Additionally, although the digital technology revolution has prioritized customer service, staff engagement must remain a priority, [29]. Another critical aspect is to communicate

organizational values and how new technology adoption benefits employees. Workers' value is obvious and fosters an environment conducive to the seamless adoption of new technologies given that employees benefit from a transparent company, [30]. The type of ideal value alignment increases competitiveness, stimulates innovation, and introduces new technology, most notably in areas undergoing an organizational upheaval.

Employees who believe they can support the company mission statement would develop an interest in their work and a desire to perform more. Furthermore, considering that customers prefer conducting business with firms that support causes they care about, staff seek mutual ideals and efficient connections, [31]. Resultantly, employees may feel more empowered to form decisions about digital technology. Thus, the study proposed a direct relationship between perceived effective communication and the performance as follows:

***H_4*:** There is a significant relationship between communication effectiveness and digital technology adoption.

7 The Relationship between Perceived Digital Literacy and Digital Technology Adoption

Employees with digital literacy could efficiently identify, comprehend, and utilize digital technology and facilities for digital tools identification, navigation, control, incorporation, appraisal, comprehension, and synthesis and to learn new skills, establish media expression, and communicate with others in the real world to facilitate positive social action, [29]. Employees' digital learning is critical as a source of expertise for digital culture involvement. Moreover, technologically skilled individuals should retain sophisticated digital capabilities, the ability to define computer interfaces, and computer network skills.

The action enables people to examine data, form logical inferences, and identify value-added solutions. People can gain more familiarity with emerging technological difficulties and raise their ability to think critically about social issues. The abilities required to succeed in a future global economy would change dramatically. The changes in business and educational culture and governments worldwide have integrated digital education into school curricula, [30]. The current research analyzed the direct relationship between employees' digital literacy and their digital technology use, thus forming the following hypothesis:

***H_5*:** There is a significant relationship between perceived digital literacy and digital technology adoption.

8 Relationship between Leadership Effectiveness and Digital Technology Adoption

Researchers have recently investigated the theoretical implications of leadership effectiveness, which affects workers as a result of increasing technologies, [31]. Although scholars have explored technology use for leadership purposes, such as connection, a comprehensive paradigm for technology use in administration has not been formed for over a decade, [32]. Neufeld et al., [33] discovered that employees' belief in successful interaction indicates a chasm in their expectations of leaders' efficacy. Leaders and employees must collaborate to ensure the success of developing technologies within an organization, [34]. Past studies have disclosed that administration effectiveness varies significantly when leaders and staff do not collaborate, [35]. Additionally, the leader aids technical exchanges with employees due to insufficient face-to-face connection, [36].

Venkatesh et al., [37], noted that changing specific communications methods would have little impact on the fundamental social structures linked with leadership. Thus, the leadership effectiveness approach to leadership provides the solution to the challenge as it encourages leaders to use technology to guide and inspire people to utilize emerging tools to strengthen the business. Hence, the study examined the direct relationship between leadership effectiveness and the use of digital technology through the following hypothesis:

H_6: There is a significant relationship between leadership effectiveness and digital technology adoption.

9 Mediating the Relationship between Perceived Usefulness, Leadership Effectiveness, and Digital Technology Adoption

Consumer usage behaviors can be influenced by perceived ease of use and perceived utility. Perceived usefulness affects a person's confidence and leadership, [38]. When evaluating the usage of current technology, the assumed utility of an information system was the most crucial factor. New technology adoption was slightly higher than the predicted correlation between the simplicity of use and digital technology adoption, [20], [39], [40]. Nonetheless, leaders have substantially impacted how employees perceive new technology as advantageous and how they utilize the technology. Thus, attitude represents potential employees' readiness to understand and can thus be positively connected with values and leadership effectiveness, [41]. For the supposed value, scholars have discovered that the leader's activities indirectly impacted the acceptability of emerging technologies, [42]. Incentives and value interpretation are the primary motivating factors in the adoption of developing technology in the sector, [42].

The more straightforward the technology operation, the more meaningful the employees' sense of usefulness and personal autonomy, [43] in terms of their ability to execute the sequences of activities needed for the technology to function. Nonetheless, leadership quality is a relatively recent development and lacks investigation despite the growing awareness of leadership efficacy through the utilization of a digital technology paradigm. Corporate leaders may be at a competitive disadvantage if they lack training on how to harness developing technology to influence people, [44]. A lack of theoretical paradigm for emerging technology leadership performance might affect how digital technologies are implemented in a company, [45]. Thus, leadership efficiency could mediate the relationship between perceived ease of use and digital technology adoption.

Van Laar, Van Deursen, Van Dijk and De Haan, [46] listed several concerns surrounding the application of emerging technologies including cost-effectiveness versus leadership. Developing technology may be a significant expense for numerous firms and the leadership effectiveness in digital technologies is critical in determining organizational success, [47]. The corporation must decide whether the capital budget is worth the investment in the emerging digital technologies considering that the extra value or the cost would be better spent elsewhere, [48]. Moreover, optimism about emerging advancements is the main factor that motivates a manager to adopt technology, [49]. Various studies described that leadership performance and actions are integrated into a single system, [50]. Nevertheless, the attitude is influenced by various antecedent characteristics, including technical skill, cognitive capacity, and confidence in the necessity of technology. Additionally, leadership in digital technology is constantly developing in response to historical variables, such as gaining a sound comprehension of how digital networks operate or discovering new digital technology applications, [51]. Therefore, the more effective new technology is integrated into an organization, the more likely the new technology will be used in a perceived cost-effective manner.

The new technology adoption occurs at the same rate as grapevines in an organization. As new technology is introduced, all organizational members must understand and participate in the vision, priorities, and road map for the transformation, [52]. Leaders must first consider the overall view and the variables influencing the growing technology adoption and transition in the organization, then consider the methods and expertise necessary to push others in the same direction, [53].

The technology installation affects the leadership comprehension and technology acceptance, thus altering the form and classification of adoption employed in education. New technologies cause developments in digital literacy and digital knowledge and transformed the format of information distribution, [54]. Digital literacy provides leaders and employees with the ability to employ innovations for information analysis, assessment, development, and collaboration that entails the acquisition of non-cognitive and technical abilities, [55]. Therefore, the emphasis has shifted to the leaders who design a strategy for introducing and promoting emerging technology and digital technologies in the sectors, hence altering fundamental business processes. Consequently, the following hypotheses are presented to test and strengthen the mediating impact of leadership effectiveness on perceived digital literacy and digital technology adoption:

***H_7*:** Leadership effectiveness mediates the relationship between perceived usefulness and digital technology adoption.

***h*$_8$:** Leadership effectiveness mediates the relationship between perceived ease of use and digital technology adoption.
***H*$_9$:** Leadership effectiveness mediates the relationship between perceived cost-effectiveness and digital technology adoption.
H$_{10}$**:** Leadership effectiveness mediates the relationship between perceived communication effectiveness and digital technology adoption.
***H*$_{11}$:** Leadership effectiveness mediates the relationship between perceived digital literacy and digital technology adoption.

10 Conceptual Framework

The framework below (see Figure 1) is employed to convey the tested hypotheses.

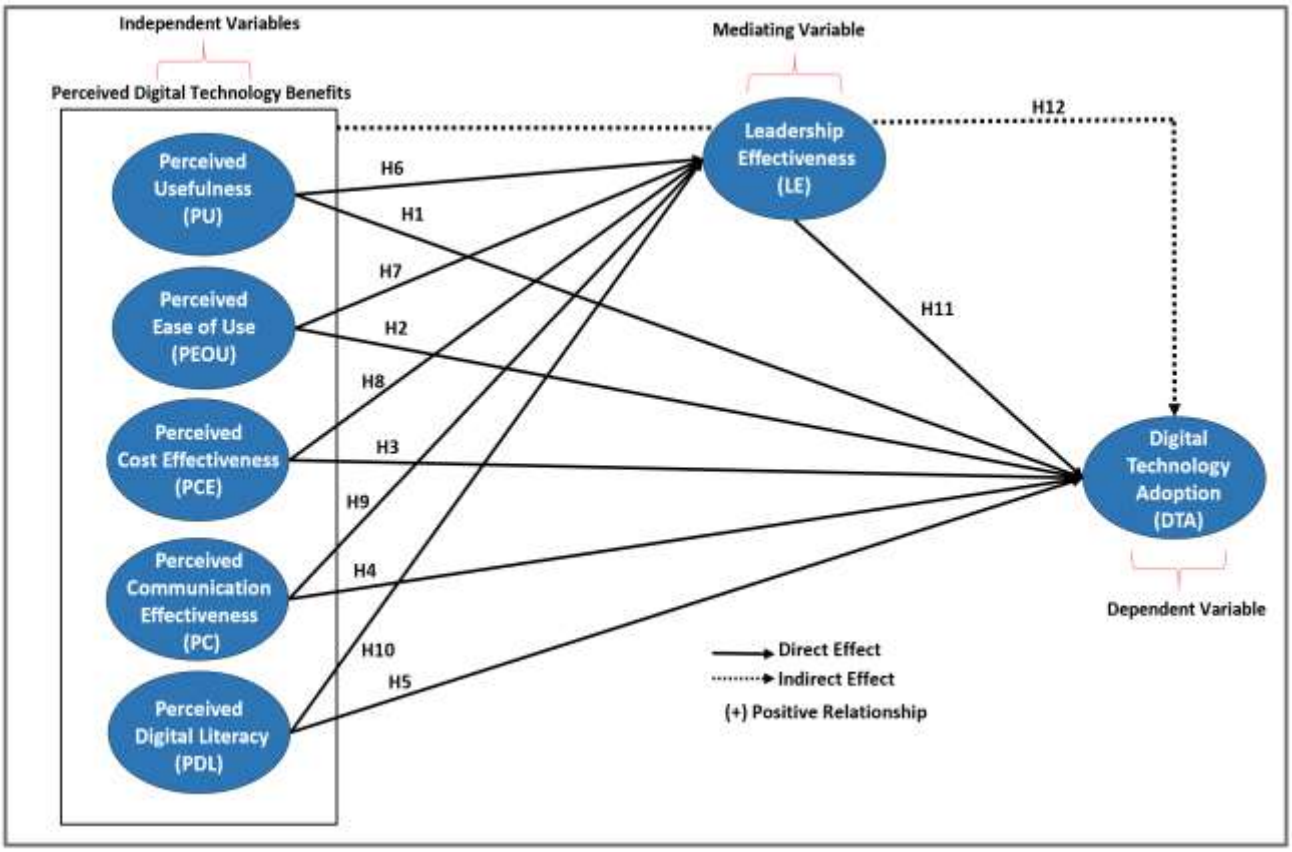

Fig. 1: The Study Conceptual Framework

11 Data Collection

Kumar, [56] defines 'respondent selection' as the set of population items where the sample will be selected. Locating complete lists or documents comprising all elements in the sample population is challenging. The population sample unit was identified as E&E manufacturing company directors, managers, executives, supervisors, and business leaders. The list of respondents was gathered from the directories of the Malaysian Manufacturers Federation (FMM) 2018 and the Small Medium Enterprise (SME) Directory Malaysia 2017. Information in both folders is categorized by economic operation, company type, product or service type sold, and geographic region. Table 1 demonstrates the study population including E&E companies in Malaysia selected for data collection.

Table 1. Respondent Selection

No	Selection of respondents	No. of Company
1	FMM Directory	403
2	SME Directory	397
3	Overlapping between FMM and SME Directories	(32)
	Total Population Size	768

Note. FMM = Federation of Malaysian Manufacturers; SME = Small Medium Enterprise

The analysis involved 768 E&E manufacturing businesses where a sample size over 400 was proposed for a population of 768. A convenient sampling procedure was applied to randomly select 23 industrial practitioners from varying subsectors in the automotive industry for the pre-test. In the pilot study and primary data collection, probability sampling and a systematic sampling approach were applied to select respondents from FMM 2018 and SME Directory Malaysia 2018 directories. Based on the produced list, any odd number of E&E manufacturing companies were chosen for the survey. The following E&E manufacturing companies were established after selecting the E&E manufacturing SME if none of the selected E&E manufacturing companies was contactable.

12 Instrument Development

Table 2 presents the operationalization of all variables in the analysis. Wagner, Mendez, Felderer, Graziotin, & Kalinowski, [57], described operationalization as "developing specific research procedures (operations) leading to empirical observations representing those concepts in the real world." Wright, [58], stated that "Operationalization is the process of precisely delineating how to measure a construct; that is, the variables to be specified in such a way as to be potentially observable or manipulated." Therefore, all structures in the questionnaires were operationally described to test the study hypotheses.

Wright, [58] emphasized that the best response scale can be clearly understood, ascertained, easily interpreted, and has a response with minimal bias. Therefore, a five-point Likert scale was used for all study variables measured by strongly disagree, disagree, neutral, agree, and strongly agree. The Likert scale allows an item to be measured with a scale ranging from negative to positive, [59].

Table 2. Questionnaire Development

Variable	Statement	Source
Perceived Usefulness	Digital technology helps me to perform tasks faster.	[20]
	Digital technology increases my work efficiency.	
	Digital technology adoption increases my productivity.	
	Digital technology adoption increases my work knowledge.	
	Digital technologies make it easier to do my work.	
	Digital technologies are useful in my work.	
Perceived Ease of Use	I find learning to manage digital technology accessible.	[20]
	I find new technologies easy to do what I want to do.	
	Using digital technologies is simple and understandable.	
	Using digital technologies is complicated.	
	It is easy to know how to execute tasks using digital technologies.	
	I find digital technologies easy to use.	
Perceived Cost Effectiveness	I think digital technologies are cost-effective.	[21]
	I think new solutions have reduced overall digital technology costs.	
	I think wireless interaction is cost-effective.	
	I think digital technologies developments have reduced total operational cost.	
	I think digital technologies have improved organisational revenue.	
	I think digital technologies will track and measure operational efficiency.	

Perceived Digital Literacy	I know how to open files.	[55]
	I know how to upload files.	
	I get tired when looking for information online.	
	I know how to open a new tab in my browser.	
	I know how to use shortcut keys (CTRL-C for copy, CTRL-S for save).	
	I find it hard to decide what the best keywords are to use for online searches.	
Effectiveness of Communication	I am kept well informed about organizational plans and progress.	[28]
	I am kept well informed about my work plans and progress.	
	In most situations, I receive appropriate information to perform my tasks well.	
	The organisation frequently conducts a meeting to share information.	
	There are opportunities available to me to express my ideas to the management.	
	There is good communication between people in different areas of the organisation.	
Leadership Effectiveness	It is important for leaders to share information with team members.	[33]
	Leaders should create informal opportunities for employees to share information.	
	Effective leaders view honest mistakes as meaningful learning opportunities.	
	It is a leader's responsibility to model appropriate team behaviour among employees.	
	It is important for leaders to take time to discuss with their employee of the plans for each task.	
	Leaders should ensure that team members help each other out when necessary.	
Digital Technology Adoption	I can easily access the available technology in my workplace when I need it.	[37]
	I feel confident in my ability to integrate multiple technologies into my work.	
	I believe that integrating technology into my work is important for organisational success.	
	Integrating technology is not pertinent to my work.	
	The amount of time needed to use digital technologies encourages me to use them.	
	I am familiar with what technology is available to me in my workplace.	

The study used an online survey (Google Form) and email questionnaire to communicate with respondents about technological innovation. The justification for embracing online surveys and email is immediate access to extensive communities within a short timeframe, [59]. Furthermore, a web survey encourages information collection from geographically scattered E&E production firms.

An online survey provides an extensive range of stylistic formats to present a questionnaire and the option to filter the reasoning flow ensures respondents' uncertainty. Moreover, an online survey minimizes missing answers by limiting respondents to the next segment before finishing the current section. Finally, using an online survey produces fast data extraction and interpretation research given that respondents' responses are registered in a database.

13 Findings

The data screening, reliability, and validity findings are discussed below. The section also discusses the partial least squares structural equation modelling (PLS-SEM) results, which contain the measurement and structural models including results of descriptive analysis, the measurement model assessment, the structural model assessment and bootstrapping, and path analysis.

Demographic Background of Respondents

The study sample comprises 142 females and 269 males with most respondents between 31 to 40 years old. Moreover, most respondents were from Kuala Lumpur, Labuan, and Putrajaya, Malaysia (36.65 per cent). The respondents also graduated from different disciplinary areas with a majority of Degree holders (27.18 per cent) followed by Master's graduates (88 respondents). Most respondents had working experience between two to three years (27.67 per cent) (See Table 3).

Table 3. Respondents' Demographic Background

Gender	Frequency	Percentage
Female	142	34.5
Male	269	65.3
Total	412	100.0
Age (years)	Frequency	Percentage
41 - 50	8	1.9
20 – 30	81	19.7
31 - 40	136	33.0
41 - 50	44	10.7
51 - 60	1	.2
States	Frequency	Percentage
Johor Baharu	44	10.68
Melaka	34	8.25
Penang	55	13.35

Perak	24	5.83
Selangor	32	7.77
Wilayah Persekutuan (Kuala Lumpur, Labuan, Putrajaya)	151	36.65
Education Qualification	Frequency	Percentage
Degree	112	27.18
Diploma	56	13.59
Bachelor	43	10.44
Masters	88	21.36
PhD	34	8.25
Secondary	33	8.01
Other	46	11.17
Marital Status	Frequency	Percentage
Married	198	48.06
Single	214	51.94
Working Experience	Frequency	Percentage
Under 2 years	56	13.59
2 - 3 years	114	27.67
4 - 6 years	94	22.82
7 - 8 years	74	17.96
9 - 10 years	33	8.01
> 10 years	41	9.95
Total	412	100.0

13.1 Missing Data Evaluation

Hair et al., [60] noted that "the researcher's first concern should be to uncover the patterns and linkages underlying the missing data to keep the original distribution of values as closely as feasible when any cure is implemented." Typically, missing data happens when a respondent fails to respond to one or more questions, [60]. The two forms of missing data are ignorable missing data where no specific remedy is required and non-ignorable missing data that occurs when respondents do not complete the questionnaire in its entirety. Using the Smart Partial Least Squares (SmartPLS) test, no missing data were discovered in the data.

13.2 Evaluation of Outliers

The initial step in analyzing the latent variable distribution is to identify outliers. Outliers are observations that exhibit a specific mix of traits that distinguish them from other observations, [60]. Outliers are defined as extremely high or extremely low scores, which can produce data that are not normally distributed and outcomes that are skewed by unexpected or unrealistic data. When outliers are identified, a decision to retain or delete the cases must be made, [60]. The current study applied the Box and Whisker (BoxPlot) approach to identify outliers and discovered no outliers in the data.

13.3 Normality Test

Kurtosis and Skewness statistics have been utilized to determine the normality of data distribution. The study used the statistical package for social sciences (SPSS) version 24.0 for Windows to conduct the tests. First, the most frequently utilized critical value for the Kurtosis and Skewness tests is 2.58., [60]. The Kurtosis test confirms the data normal distribution, while the Skewness test was used to explain the distribution balance, [60]. Kurtosis and Skewness tests disclosed that all variables in the study were normally distributed (see Table 4).

Table 4. Descriptive Statistics

	No.	Missing	Mean	Median	Standard Deviation	Kurtosis	Skewness
PU1	8	0	4.054	4	1.153	0.828	-0.955
PU2	9	0	4.054	4	0.709	2.041	-0.898
PU3	10	0	4.034	4	0.741	1.628	-0.884
PU4	11	0	4.117	4	0.742	1.819	-0.908
PU5	12	0	4.299	4	0.68	1.446	-0.875
PU6	13	0	4.2	4	0.676	1.237	-0.693
PE1	14	0	3.898	4	1.027	0.689	-0.821
PE2	15	0	3.852	4	0.984	0.548	-0.791
PE3	16	0	3.939	4	0.983	1.136	-1.002
PE4	17	0	4.054	4	0.992	1.42	-0.917
PE5	18	0	4.015	4	1.008	1.022	-0.815
PE6	19	0	4.158	4	0.962	1.664	-0.896
PDL1	20	0	3.961	4	0.993	0.839	-1.044
PDL2	21	0	3.866	4	1.001	0.579	-0.928
PDL3	22	0	3.951	4	1.071	0.755	-1.097
PDL4	23	0	3.642	4	1.155	-0.323	-0.716
PDL5	24	0	3.681	4	1.115	-0.262	-0.667
PDL6	25	0	3.443	4	1.189	-0.526	-0.621
PCE1	26	0	4.063	4	0.712	1.998	-0.823
PCE2	27	0	3.869	4	1.147	0.501	-1.09
PCE3	28	0	3.925	4	1.049	1.013	-1.18
PCE4	29	0	3.886	4	1.03	0.702	-1.018
PCE5	30	0	3.856	4	1.134	0.291	-1.012
PCE6	31	0	4.075	4	0.719	2.869	-1.058
EOC1	32	0	3.946	4	1.002	0.686	-0.999

EOC2	33	0	4.148	5	1.074	-0.057	-1.091
EOC3	34	0	3.457	4	1.224	-0.545	-0.6
EOC4	35	0	3.766	4	1.109	-0.847	-0.592
EOC5	36	0	4.092	4	1.038	0.76	-1.209
EOC6	37	0	4.01	4	0.979	1.59	-1.253
LE1	38	0	4.114	4	0.711	1.725	-0.822
LE2	39	0	4.163	4	0.669	1.455	-0.691
LE3	40	0	4.2	4	0.676	1.237	-0.693
LE4	41	0	3.496	4	1.113	-0.467	-0.368
LE5	42	0	4.095	4	0.734	1.025	-0.929
LE6	43	0	4.153	4	0.682	0.919	-0.665
TA1	44	0	4.122	4	0.704	1.739	-0.805
TA2	45	0	4.168	4	0.661	1.427	-0.655
TA3	46	0	4.212	4	0.667	1.215	-0.667
TA4	47	0	3.45	3	1.135	-0.48	-0.377
TA5	48	0	4.109	4	0.712	1.691	-0.813
TA6	49	0	4.168	4	0.664	0.853	-0.602

13.4 Internal Consistency Reliability

Internal consistency reliability testing assesses the degree of consistency between numerous measurements (indicators) of a construct, [61]. The study used Cronbach's Alpha and composite reliability to measure internal consistency. Cronbach's Alpha is a broadly applied criterion for evaluating internal consistency as it provides a measure of dependability based on the observed intercorrelation of indicator variables, [61]. Cronbach's Alpha indicates the instruments internal consistency, which may be less than or over 0.7. The results in Table 5 imply that the values for Cronbach's Alpha are all greater than 0.70, which ensures the instruments internal consistency, [60].

Table 5. Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Cost Effectiveness	0.721	0.704	0.778	0.506
Digital Technology Adoption	0.800	0.806	0.862	0.555
Effectiveness of Communication	0.711	0.769	0.813	0.526
Leadership Effectiveness	0.811	0.817	0.869	0.569
P Digital Literacy	0.763	0.773	0.833	0.556
P Ease of Use	0.866	0.889	0.898	0.596
Perceived Usefulness	0.793	0.745	0.732	0.528

Composite reliability analysis considers the indicator variable varying outer loading and does not assume that every indicator produces the same loading, [60]. A composite dependability value of 0.70 to 0.90 is considered satisfactory. A number over 0.90 is undesirable as it indicates that all indicator variables are redundant and hence the constructed measure is unlikely to be genuine, [64].

13.5 Convergent Validity

Convergent validity is the extent to which a measure correlates with alternative measures of the same construct, [60]. Convergent validity can be established by assessing an average variance extracted (AVE). The AVE describes how a latent structure determines the conflict of its measures, [60]. Table 4.1 illustrates that all the AVEs are 0.5, hence suggesting that the minimum requirement to meet the convergent validity was achieved. Therefore, at least 50% of each indicator variance is explained by latent variables, [60].

13.6 Discriminant Validity

Discriminant credibility is how a concept varies from other constructs, [60]. Therefore, forming distinguishing validity means that an idea is different and not represented in the proposed model by other constructs, [60]. Table 6 indicates the AVE square root to implicit correlation where all constructs square root AVEs were higher than their highest correlation with other constructs, [60].

Table 6. Discriminant Validity (Fornell-Larcker Criterion)

	Cost Effectiveness	Digital Technology Adoption	Effectiveness of Communication	Leadership Effectiveness	Digital Literacy	Ease of Use	Perceived Usefulness
Cost Effectiveness	0.621						
Digital Technology Adoption	0.478	0.745					
Effectiveness of Communication	0.308	0.210	0.725				
Leadership Effectiveness	0.472	0.972	0.206	0.755			
P. Digital Literacy	0.264	0.302	-0.029	0.297	0.675		
P. Ease of Use	0.199	0.130	0.342	0.143	-0.003	0.772	
Perceived Usefulness	0.465	0.753	0.183	0.774	0.379	0.157	0.599

Cross-loading exhibited no lack of distinguishing consistency if two concepts are ideally connected. Meanwhile, the heterotrait-monotrait (HTMT) is an aggregate of all indicator relationships around indicators measuring the same construct relative to average correlations of indicators measuring the same structure, [60]. Thus, a disregarded comparison between two constructs close to one suggests that the concepts indicate a lack of

distinguishing accuracy. Therefore, the HTMT score should be less than 0.90, [60]. Table 7 demonstrates that all the HTMT scores were under 0.90.

Table 7. The HTMT values

	Cost Effectiveness	Digital Technology Adoption	Effectiveness of Communication	Leadership Effectiveness	Digital Literacy	Ease of Use	Perceived Usefulness
Cost Effectiveness							
Digital Technology Adoption	0.613						
Effectiveness of Communication	0.708	0.262					
Leadership Effectiveness	0.627	1.207	0.253				
P. Digital Literacy	0.333	0.370	0.098	0.362			
P. Ease of Use	0.622	0.149	0.431	0.161	0.068		
Perceived Usefulness	0.635	0.935	0.302	0.954	0.544	0.179	

13.7 The Structural Model Evaluation

The structural model assessment result determines the model capability to predict target constructs, [64]. The structural model assessment is categorized into five components. First, identify collinearity in the structural model. Second, evaluate the structural model linkages importance and relevance. Third, establish the coefficient of determination level. The fourth step determines the degree of impact size and the fifth step evaluates the predictive significance.

13.8 Collinearity Assessment

A related measure of collinearity is the variance inflation factor (VIF). A VIF of five and above indicates a potential collinearity issue, [64]. Therefore, this study considers removing the indicators with VIF of five and above, [64]. Nevertheless, the remaining indicators still capture the construct content theoretically. Otherwise, combine colinear indicators into one (new) composite indicator. Multicollinearity can occur due to a high correlation between two or more additional independent variables, [61]. Consequently, a metric is required to quantify the extent to which each independent variable is affected by the collection of other independent variables, [64]. The VIF and tolerance value are two methods for determining multicollinearity. The VIF was used to test for multicollinearity amongst variables (VIF). Each construct VIF value should be less than five to prevent multicollinearity, but the VIF value is still acceptable if less than 10, [61]. Tables 8 and 9 display that all the VIF values are less than 5, which is acceptable.

Table 8. Inner VIF Values

	Digital Technology Adoption	Leadership Effectiveness
Cost Effectiveness	1.583	1.538
Digital Technology Adoption		
Communication Effectiveness	1.299	1.299
Leadership Effectiveness	4.078	
P. Digital Literacy	1.776	1.725
P. Ease of Use	1.305	1.303
Perceived Usefulness	4.898	1.754

Table 9. Outer VIF Values

Factor	VIF
EOC1	1.208
EOC2	1.228
EOC3	1.890
EOC4	1.790
EOC5	1.773
EOC6	1.742
LE1	1.652
LE2	1.675
LE3	1.579
LE4	1.043
LE5	1.658
LE6	1.481
PCE1	1.328
PCE2	2.088
PCE3	2.114
PCE4	2.033
PCE5	1.878
PCE6	1.320
PDL1	1.568
PDL2	4.099
PDL3	1.693
PDL4	4.483
PDL5	1.381
PDL6	4.499
PE1	2.666
PE2	2.933
PE3	2.208

PE4	3.711
PE5	3.959
PE6	2.039
PU1	1.448
PU2	1.396
PU3	1.282
PU4	1.279
PU5	1.221
PU6	1.488
TA1	1.629
TA2	1.657
TA3	1.547
TA4	1.038
TA5	1.595
TA6	1.429

Outer Loadings

Indicator dependability denotes the proportion of indicator variance explained by the latent variable, [61]. Manifest variables with an outer loading of 0.7 or over are considered highly satisfactory, the values with an outer loading of 0.5 are deemed acceptable, while outer loadings of 0.4 are regarded as acceptable, [61]. Henseler et al., [62], suggested that manifest variables with low loadings should be considered for deletion. If omitting the signs improves the composite dependability, they should be deleted. The outer loadings for manifest variables in the conceptual model are illustrated in Table 8 with each loading exceeding. Most loadings are deemed highly satisfactory and signify that they fulfilled requirements for individual item reliability. Nonetheless, the loading of less than 0.5 was deleted, [62]. Figure 2 depicts the structural model after the low loadings were omitted.

Table 10. Outer Loadings

Communication Effectiveness	EOC1	0.232
	EOC2	0.233
	EOC3	0.671
	EOC4	0.69
	EOC5	0.788
	EOC6	0.823
Leadership Effectiveness	LE1	0.754
	LE2	0.769
	LE3	0.768
	LE4	0.242
	LE5	0.766
	LE6	0.706
Cost Effectiveness	PCE1	0.81
	PCE2	0.602
	PCE3	0.38
	PCE4	0.308
	PCE5	0.351
	PCE6	0.756
Digital Literacy	PDL1	0.722
	PDL2	0.855
	PDL3	0.755
	PDL4	0.885
	PDL5	0.651
	PDL6	0.909
Ease of Use	PE1	0.797
	PE2	0.798
	PE3	0.818
	PE4	0.871
	PE5	0.829
	PE6	0.727
Perceived Usefulness	PU1	0.77
	PU2	0.611
	PU3	0.556
	PU4	0.565
	PU5	0.544
	PU6	0.789
Digital Technology Adoption	TA1	0.753
	TA2	0.766
	TA3	0.76
	TA4	0.208
	TA5	0.755
	TA6	0.683

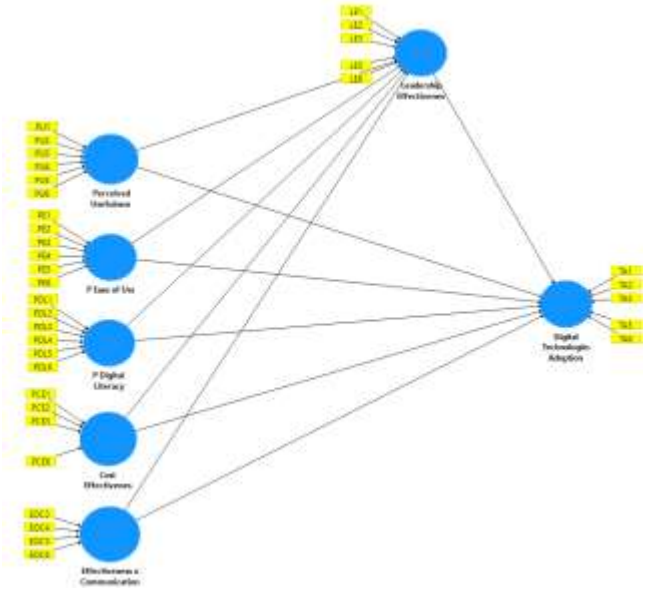

Fig. 2: The structural model after the low loadings were omitted

13.9 Assessment of the Model Fit

The proposed structural model was assessed after evaluating the measurement model validity and reliability. The model was applied to derive parameters that best predict endogenous components from the sample data. The PLS lacks a conventional goodness-of-fit measure, hence the model quality was determined by its ability to predict endogenous constructs. The coefficient of determination (R2), cross-validated redundancy (Q2), path coefficients, and effect magnitude (f 2) all contribute to the judgment. The model explanatory capability was tested using bootstrapping, a technique that computes the significance of Partial Least Coefficients (PLS) coefficients using resampling approaches.

Digital technology adoption and leadership effectiveness adjusted R-squared scores (confidence interval bias-corrected) enable an understanding of the amount of variance explained by them and independent factors (see Table 11). The resulting model enhanced predictability and R2 values (0.946 and 0.616). The PLS researchers emphasised that including control variables considerably diminishes the effect, regardless of its importance, [61].

Table 11. R-Square Values

	R Square	R Square Adjusted
Digital Technology Adoption	0.946	0.945
Leadership Effectiveness	0.616	0.611

The determination coefficient (R2) is a function of statistical precision while the R2 is a mixture, influence, and a discrete factor maximum variability. The R2 ranges from 0 to 1 with higher predictive accuracy levels. The R^2 values should be high enough for the model to achieve a minimum explanatory power level. Additionally, Hair et al., [61], suggested that the R2 of endogenous latent variables should be over 0.26 for a decent model. The coefficient of determination (R2 value) suggests the predictive accuracy of a structural model and is derived as the squared correlation between the actual and projected values of an endogenous component. The R2 value implies the variance proportion in endogenous constructs explained by all exogenous constructs related to it. The R2 value was between 0 and 1 with a value closer to 1 indicating greater prediction accuracy (see Table 11).

Table 12. Fit Statistics

	Saturated Model	Estimated Model
SRMR	0.087	0.087
d_ULS	7.677	7.677
d_G	5.606	5.606
Chi-Square	7464.971	7464.971
NFI	0.923	0.923

The root mean square residual (RMSR) is a standardised root mean square residual (SRMR) that is calculated by translating the sample and projected covariance matrices into correlation matrices. Additionally, Smart PLS calculates the SRMR criterion bootstrap-based inference statistics. The exact model fit was employed to interpret the SRMR bootstrap confidence interval results. The SRMR is defined as the difference between the observed and implied correlation matrix in the model, hence enabling the average magnitude of actual and expected correlation differences to be utilised as an absolute measure of the (model) fit requirement. A number under 0.10 is deemed a satisfactory fit. The Structural Equation Modelling or SEM analysis revealed that

SRMR = 0.087, which is acceptable, [64]. SRMR is a metric of model goodness of fit for PLS-SEM that may be applied to prevent model misspecification, [62]. The normed fit index as one of the first fit measures in the SEM literature. The index calculates the proposed model Chi-squared value and compares it to a useful benchmark. Considering that the proposed model Chi-squared value does not provide adequate information to determine model fit, the NFI uses the null model Chi-squared value as a yardstick. Nevertheless, the literature does not explain why the PLS-SEM Chi-squared value is different from the Covariance Based Structural Equation Modelling (CB-SEM) value, [61].

The Normed Fit Index (NFI) is defined as 1 minus the suggested model Chi-squared value divided by the null model Chi-squared value. Consequently, the NFI produces values between 0 and 1 where a value that is closest to 1 indicates a better match. The current study NFI score is 0.964, which is more than 0.9 and suggests a satisfactory match. he NFI computation of PLS route models in detail. Nonetheless, the explanations are complicated to comprehend for the practical user. The NFI is a measure of incremental fit, thus a significant disadvantage is that model complexity is not penalised. The more parameters in the model, the greater (and therefore more accurate) the NFI result (see Table 12), [61].

The Level of Effect Size (f2) Assessment
The effect size can be evaluated via Cohen's f2 (Cohen, 1998). The f2 evaluates the relative impact of a predictor construct (independent variable) on an endogenous construct (dependent variable). Specifically, the f2 estimates how strongly one exogenous contrast contributes to explaining a specific endogenous construct. Cohen 1988) mentioned that f2 values of 0.35, 0.15 and 0.02 are considered large, medium, and small effect sizes (see Table 13), [61].

Table 13. The f-Square Statistics

	Digital Technology Adoption	Leadership Effectiveness
Cost Effectiveness	0.007	0.033
Digital Technology Adoption		
Communication Effectiveness	0.002	0.003
Leadership Effectiveness	6.619	
P. Digital Literacy	0.003	0.000
P. Ease of Use	0.004	0.000
Perceived Usefulness	0.000	0.916

13.10 Hypotheses Testing

After confirming the structural model validity, the following stage evaluates the proposed structural model path where each path corresponds to one of the hypotheses. The study evaluated the assumptions by applying a bootstrapping method on subsample randomly generated (with replacements) from the original dataset, [60]. The sign, magnitude, and statistical significance of the path coefficient between the latent variable (LV) and its dependent variables were employed to evaluate each hypothesis. The greater the route coefficient, the more effective LVs are at affecting the dependent variable. The proposed relationship will be statistically significant at $p < 0.05$, [60].

13.10.1 Path Analysis

Bootstrapping ensures validity robustness and outcome stability, [60]. After bootstrapping, the structural model signified the strength of the relationship between the independent factors and the dependent variable through the route coefficient estimates (see Table 14).

Table 14. Path Coefficients

	Original Sample	Sample Mean	Standard Deviation (STDEV)	T-Statistics	P-Values
Cost Effectiveness -> Digital Technology Adoption	0.023	0.022	0.022	1.041	0.299
Cost Effectiveness -> Leadership Effectiveness	0.334	0.137	0.045	2.991	0.003
Communication Effectiveness -> Digital Technology Adoption	0.211	0.012	0.016	0.726	0.042
Communication Effectiveness -> Leadership Effectiveness	0.037	0.037	0.033	1.116	0.265
Leadership Effectiveness -> Digital Technology Adoption	0.962	0.963	0.024	40.148	0.000
P. Digital Literacy -> Digital Technology Adoption	0.203	0.013	0.010	1.374	0.010
P. Digital Literacy -> Leadership Effectiveness	-0.006	-0.002	0.034	0.177	0.860
P. Ease of Use -> Digital Technology Adoption	-0.015	-0.014	0.015	1.044	0.297
P. Ease of Use -> Leadership Effectiveness	-0.007	0.000	0.029	0.251	0.802
Perceived Usefulness -> Digital Technology Adoption	-0.007	-0.006	0.014	0.472	0.637
Perceived Usefulness -> Leadership Effectiveness	0.708	0.707	0.037	19.378	0.000

Table 15 depicts a significant relationship between Cost Effectiveness and Leadership Effectiveness (Beta = 0.334, P-value < 0.05). Moreover, Communication Effectiveness positively influenced Digital Technology Adoption (Beta = 0.211, P-value < 0.05) while Perceived Digital Literacy significantly influenced Digital Technology Adoption (Beta = 0.203, P-value < 0.05). The results also indicated a direct strong effect of Perceived Usefulness on Leadership Effectiveness with a coefficient of 0.708 (P value = 0.000), [61]. Interestingly, the results presented a strong relationship between Leadership Effectiveness and Digital Technology Adoption Beta = 0.962, P-value < 0.05).

Table 15. Indirect Effects

	Original Sample	Sample Mean	Standard Deviation (STDEV)	T Statistics	P Values
Cost Effectiveness -> Digital Technology Adoption	0.122	0.025	0.015	1.513	0.013
Communication Effectiveness-> Digital Technology Adoption	0.208	0.008	0.008	0.894	0.02
P. Digital Literacy -> Digital Technology Adoption	-0.001	0.003	0.008	0.179	0.858
P. Ease of Use -> Digital Technology Adoption	-0.008	-0.003	0.008	1.000	0.318
Perceived Usefulness -> Digital Technology Adoption	0.843	0.836	0.179	4.723	0.000

13.10.2 Mediation Analysis

Mediation occurs when a third variable is distorted from exogenous variables by dependent ones. The mediator regulates the relationship between exogenous and endogenous variables, [64]. Tables 14 and 15 illustrate insignificant direct effects of Cost-Effectiveness, Effectiveness of Communication, Perceived Digital Literacy, and Leadership Effectiveness on Digital Technology Adoption. The indirect effects of Cost-

Effectiveness, Effectiveness of Communication, and Perceived Usefulness of Digital Technology Adoption are also significant. Therefore, the results indicated a full mediation of Leadership Effectiveness on the relationship between Cost Effectiveness and Digital Technology Adoption, which signifies that the indirect influence of the mediator, [61]. Full mediation implies that the effect of Cost-Effectiveness on Digital Technology Adoption is entirely transferred via another variable Leadership Effectiveness. Additionally, the condition Digital Technology Adoption entirely absorbs the beneficial or detrimental impact of Cost-Effectiveness, only under a specific condition imposed by Leadership Effectiveness. The findings also indicate a partial mediation of Leadership Effectiveness on the relationship between Effectiveness of Communication and Digital Technology Adoption due to significant direct and indirect influences on the DV. The direct and indirect effects of Communication Effectiveness point in the same (positive) direction, which implies a complementary partial mediation, [61]. Thus, a component of Communication Effectiveness effects on Digital Technology Adoption was mediated by Leadership Effectiveness, while Effectiveness of Communication still adequately explained a portion of DV independently of Mediation.

Similar to Cost Effectiveness, the results suggested a full mediation of Leadership Effectiveness on the relationship between Perceived Usefulness and Digital Technology Adoption. Table 16 demonstrates the Hypotheses Testing results summary.

Table 16. Hypotheses Testing Summary

	Hypothesis	Result
H_1:	There is a significant relationship between perceived usefulness and digital technology adoption.	Unsupported
H_2:	There is a significant relationship between perceived ease of use and digital technology adoption.	Unsupported
H_3:	There is a significant relationship between perceived cost-effectiveness and digital technology adoption.	Unsupported
H_4:	There is a significant relationship between communication effectiveness and digital technology adoption.	Supported
H_5:	There is a significant relationship between perceived digital literacy and digital technology adoption.	Supported
H_6:	There is a significant relationship between leadership effectiveness and digital technology adoption.	Supported
H_7:	Leadership effectiveness mediates the relationship between Perceived Usefulness and digital technology adoption.	Supported
H_8:	Leadership effectiveness mediates the relationship between Perceived Ease of Use and digital technology adoption.	Unsupported
H_9:	Leadership effectiveness mediates the relationship between perceived cost-effectiveness and digital technology adoption.	Supported
H_{10}:	Leadership effectiveness mediates the relationship between perceived communication effectiveness and digital technology adoption.	Supported
H_{11}:	Leadership effectiveness mediates the relationship between perceived digital literacy and digital technology adoption.	Unsupported

14 Discussion

Malaysia developed a standard definition of SMEs endorsed by the National SME Development Council (NSDC) and adopted by all Ministries and agencies, financial institutions, and regulators involved in SMEs development programmes. The creation and acceptance of a common definition of SMEs are essential for aiding better identification of SMEs across sectors and for the formulation and execution of more effective SMEs policies and development initiatives. Additionally, the definition could provide a more precise assessment of the contribution and SMEs advancement to the Malaysian economy. The SME is a term that varies by country, while SME characteristics include the number of employees, invested capital, total assets,

annual revenue, production capacity, and average income. The respondents stated that the path analysis results indicate no significant relationship between perceived ease of use and technology adoption. (P = 0.297).

Perceived usefulness assessed intrinsic technological characteristics and was predicted to impact the intended utilization only for activities that are inherent to the technology- when the technology performs the fundamental task activity. The study presented that perceived utility is a dynamic construct with varying degrees and consequences based on the type of technology used. Interestingly, the findings demonstrated that perceived usefulness indirectly affected technology adoption via the mediating role of leadership effectiveness. The findings could contribute to understanding a vital TAM research area, namely when and why perceived usefulness affects the intention to adopt technology in the manufacturing business.

The respondents also mentioned that the path analysis results suggested no significant relationship between perceived ease of use and technology adoption. (P = 0.860). Perceived ease of use denotes the extent to which an individual is free of physical and mental effort when operating a specific technology, [20]. A simple-to-use programme has a greater probability of being approved by workers. Employee opinions of ease of use signify how much effort is needed to use automated technologies or how simple they are to use, [20]. Ease of use is crucial to embracing and utilize modern technologies. Davis, [20] proposed TAM to examine the relationship between relative advantage (perceived utility) and complexity in the adoption process (perceived ease of use). Additionally, perceived ease of use is a function of users' perceptions of the technological complexity, which influences technology adoption and highlights compatibility as an essential element determining technology adoption. Innovation in research has been defined in various ways, including its uniqueness or exclusivity, compatibility with adopters' norms and skills, the clearly visible benefits provided by innovation, the visibility of innovation in society, uncomplex technology use, and ease of trial before adoption. Hence, individuals' attitudes about technology use may vary based on their demographic background. Resultantly, several innovation characteristics may affect the pace of adoption in numerous businesses or cultures.

Cost-effectiveness is defined as the degree to which an individual perceives that utilizing a particular device will incur additional costs. Cost-cutting solutions require the adoption of full-scale digital technology or the establishment of an information technology infrastructure in the hardware and software domains. During the early stages of new technology adoption, the perceived value of developing breakthroughs is gradually considered when business investment plans are being developed, [24]. Nonetheless, SEM research revealed no significant relationship between perceived cost-effectiveness and digital technology adoption in the Malaysian manufacturing business. Therefore, the third hypothesis is rejected.

The findings indicated a significant relationship between communication effectiveness and digital technology adoption. Consequently, the fourth hypothesis is confirmed. Other scholars concur with this conclusion, [63]. Dale and Plunkett, [24] described cost-effectiveness as an individual's belief that using a particular device would be costly. Cost-cutting measures demand the adoption of full-scale digital technology or the establishment of an information technology infrastructure in the hardware and software sectors.

Communication is a vital aspect of all managerial tasks. Additionally, the capacity to communicate well with people is a necessary skill. Communication enables employees to obtain a better understanding of one another, develop an affinity for one another, influence one another, form trust, and learn more about themselves and how others view them. Effective communication is a crucial duty for every organization. Rapid and effective communication among the company numerous sectors promotes organizational flexibility, competency, and responsiveness to change.

The results indicate that when an organization suffers from an internal communication breakdown, the way information is conveyed from sender to receiver is normally disrupted. Resultantly, when an organization undergoes technological change, everyone will experience difficulty to accomplish their goals efficiently. Additionally, leaders' main function should be to disseminate knowledge to their subordinates. If employees are not informed of changes, they risk delivering false information to their coworkers. The technology adoption process involves communication hurdles that lead to misunderstanding and uncertainty. Hence, the aim should be to minimize the occurrence of the barriers at each stage of the process through the application of clear, brief, accurate, and well-

planned communications to produce a successful communicator and convey your message without misunderstanding or confusion, [63]. Professional communicators could form relationships with coworkers and business associates, thus facilitating the completion of changes promptly and successfully. Another necessary requirement is experienced personnel capable of resolving conflicts and encouraging teamwork while achieving the objective, [47]. Apart from errors and missed deadlines, a lack of good communication is at the root of a slew of other serious workplace concerns, including low employee morale and poor job performance.

The findings imply a considerable relationship between perceived digital literacy and digital technology adoption. The conclusion is consistent with the findings of other studies, such as suggested that developing an individual's digital literacy enables them to be technology-driven or project-based, [69]. Digital literacy workers are individuals who are proficient at identifying, comprehending, and utilizing digital technology and facilities for the identification, navigation, control, incorporation, appraisal, comprehension, and synthesis of digital tools, and the acquisition of new skills, media expression, and communication with others in the real world to facilitate positive social action, [55].

The DOI 'technology adoption lifespan' provides a glimpse of how humans view new technologies. The theory describes that early adopters are the first to discover novel applications for new technologies. Prior to innovations reaching the mainstream, they are tried, tested, accepted, rejected, or changed by a so-called 'digital elite.' Therefore, asymmetric epistemologies might form asymmetric literacies. Thus, the reason that adoption behaviors are linked with technology-mediated practices is distinct and may demand the development of new identity-related literacies.

Activities mediated by technology differ from other activities due to the community component. Traditional literacy is based on a scarcity-based educational philosophy and exclusionary beliefs, which was initially conducted for positive reasons: believing in meritocracy necessarily leads to the exclusion of 'everyone but the finest.' When an organizational goal is to incorporate new or unknown technology, digital literacy scarcity is a major concern. Thus, digital literacy enables employees to understand logical inferences and identify value-added solutions provided by technology and facilitates its adoption. Many businesses are gaining a holistic view of their digital workers.

Stakeholders will make no concessions on their course of action and there may be no reliable or objective information about the company digital staff available. Significant firms globally and the government purchase the digital workforce. Malaysia has regained interest while the commercial enterprise has maintained its presence in the region. Malaysians are currently accountable for ensuring that the citizens play a crucial role in developing and promoting digital technology skills globally and investing in cutting-edge digital and creative technologies from global ICT businesses. The qualities required to prosper in a future global economy will undergo major changes.

The findings indicated that leadership effectiveness substantially impacted digital technology adoption in Malaysian industrial enterprises. Neufeld et al., [33] discovered that employees' belief in successful engagement reflects a gap in their expectations of leaders' efficacy. Resultantly, comprehending the communication efficiency networks influences the decision to incorporate new technologies into the leadership model.

When a leader places a premium on in-role behavior and efficiency, employees adopt a highly disciplined approach to technology to maximize their output quantity and quality. The leaders are expected to operate the system in a specific way to limit an individual's exposure to technological complexity. If a CEO supports innovation and openness, employees will develop a greater tolerance for experimenting with new technologies and procedures and catch up on features quicker. Considering that past learning experiences foster the development of latent inventiveness, the newly presented technology could be simpler to utilize.

Although leadership styles are abstract and vast in scope, organizational facilitators can be more specific activities made by a leader or implemented within an organization. Conditions and events that promote technology adoption, such as training and education and organizational technical assistance could be considered parts of organizational facilitators. Training, knowledge, and technical support can affect an individual's ability to apply technology effectively or find it simple to use. Hands-on sessions and feedback could illustrate technological capabilities and features, hence influencing perceived usefulness.

In reality, leaders and employees must collaborate to ensure the success of developing technologies within an organization, [64]. Past

research also demonstrated that when leaders and staff do not collaborate, administration effectiveness differs significantly, [35] where evolving platforms and additional considerations are required for leaders and people to effectively embrace digital technology, [49].

The results presented that leadership effectiveness mediated the relationship between perceived usefulness and digital technology adoption. Meanwhile, the TAM predicted that factors indirectly affected behavior through their influence on perceived usefulness, perceived ease of use, or their relative weights, [20]. The findings also revealed that leadership effectiveness mediated the influence of perceived usefulness on digital technology adoption. Therefore, leadership effectiveness in Malaysian manufacturing sectors plays a critical role in digital technology acceptance behavior. In terms of perceived usefulness, employees may consider it more helpful to work with if a leader communicates the benefits of technology by emphasizing that the system is the only method to achieve defined goals. The transactional leadership style is cost-effective, which may disclose technology utility, given that technologies are frequently introduced for cost-cutting purposes. Another strategy employed by transformational leadership encourages employees to be more creative and inquisitive. Consequently, people are more likely to grasp the technology utility.

Leadership Effectiveness Mediating Effect

The results indicated no mediation effect of leadership effectiveness on the relationship between digital technology perceived ease of use to digital technology adoption in the Malaysian manufacturing sector employees. The results also suggested that leadership effectiveness mediated the relationship between perceived cost-effectiveness and digital technology adoption. Summarily, effective leadership performance for emerging innovations is the main variable encouraging the company to utilize technology. Past studies have debated that leadership performance and actions are a single system, [65]. Nonetheless, the notion is affected by numerous antecedent variables, including technical expertise, cognitive capacities, and confidence that the technology is required for a specific reason. Furthermore, digital technology leadership is constantly evolving in response to historical factors, such as acquiring more knowledge about digital network operation or seeking new digital technology applications, [65]. Resultantly, the more effective leadership incorporates new technology, the more likely it will be utilized in a perceived cost-effective organization. Thus, the study proposed to test the mediating influence of leadership effectiveness between perceived cost-effectiveness and digital technology acceptance.

The results presented that leadership effectiveness mediated the relationship between perceived communication effectiveness and digital technology adoption. Meanwhile, leadership effectiveness mediated the relationship between perceived communication effectiveness and digital technology adoption. Most research on the influence of leadership traits on business technology adoption originated in the literature on strategic management and organizational behavior, [65]. Meanwhile, many leadership attributes have been analyzed in the context of organizational innovation, only a few have been consistently proven to be key contributors to enterprise adoption decisions, specifically for perceived communication effectiveness considering that information and communication technologies could revolutionize existing organizational procedures and interactions with partners and stakeholders.

Based on the earlier discussions, the study confirmed that management endorsement and commitment demonstrated to organization members that leadership approves, believes in, and encourages new technology adoption. Past studies revealed that senior management commitment and support are a strong predictor of the success of new technology initiatives, [66]. Although evidence confirmed that emerging technology adoption, such as Blockchain, is usually driven by a grassroots movement, the study provided substantial evidence that the technology adoption and implementation process will stall or, in the worst-case scenario, fail without top management support and commitment.

Another crucial leadership attribute that influences organizational digital technology adoption is organizational innovation level. Innovativeness refers to a leader's willingness to take risks and openness to change. Inventive leaders tend to foster an environment that is receptive to change and innovation and project and communicate the mindset throughout the organization. Thus, innovative leaders are crucial in accelerating the adoption of developing new technologies. Executives with a visionary mindset create an environment conducive to ICT innovation and assist firms in progressing with successful implementations. Prior research suggested that leaders with previous experience with technology

adoptions and implementations are better prepared to share knowledge about new technology and related organizational change, [67]. The situation indicates that knowledge sharing and effective communication enable leaders to anticipate and address potential dramatic challenges due to digital technology implications. The path analysis results demonstrated that leadership effectiveness did not mediate the relationship between perceived digital literacy and digital technology adoption, hence rejecting the eleventh hypothesis.

15 Conclusion

The study investigated digital technology adoption in the E&E manufacturing industry subsector. The analysis unit is an E&E manufacturing organization registered under FMM and SME Directory Malaysia. The study investigated perceived utility, ease of use, perceived cost-effectiveness, perceived communication effectiveness, digital literacy, and leadership efficacy in Malaysian E&E production. The study developed and examined two mainstream management theories, the TAM and DOI to accomplish its objectives. The theories indicate a different viewpoint on how different variable sets will impact a company decision in the manufacturing sector on digital technology adoption.

The study employed the SEM method to evaluate the adequacy of the conceptual model and measurement assessment and the structural model. The statistical analysis identified the key drivers of Malaysian manufacturing SMEs technological acceptance processes. The path analysis results implied a significant relationship between communication effectiveness, perceived digital literacy, leadership effectiveness, and digital technology adoption. Additionally, the study confirmed that leadership effectiveness mediated the relationships between perceived usefulness and digital technology adoption, perceived cost-effectiveness, perceived communication effectiveness, and digital technology adoption.

16 Study Implications

The study contributes to the technology adoption literature by developing a novel theoretical framework for analyzing the factors influencing industrial manufacturing technology adoption in Malaysian manufacturing SMEs. The study also facilitated industrial practices by providing insight into the industrial manufacturing E&E technology adoption experiences in Malaysia. Adopting current technologies may assist Malaysian manufacturing E&Es to maintain competitiveness and viability in the business sector. Numerous factors could impact technology acceptance. The study is a pioneering examination of major components in the business and is theoretically grounded in the process of technical selection, the qualities of technology, organizational culture, and external environment framework.

Managers and owners of Malaysian manufacturing E&Es should be aware of their leadership role and the technical characteristics that may impact the ease with which certain digital technologies are adopted and implemented in their enterprises. The E&Es must adopt the correct approach to secure their survival during the digitization process, which includes an efficient communication system, effective digital literacy, effective leadership style, and technical expertise for the staff. The study could aid Malaysian manufacturing E&Es in identifying organizational communication systems, digital literacy, and leadership styles by providing a validated and quantified perspective of the entire organizational culture to promote effective business transformation. Additionally, the empirical findings emphasized the critical function of top management responsibilities in developing countries, such as Malaysia regarding manufacturing E&E new technologies adoption. Furthermore, examining external environmental factors could provide Malaysian manufacturing E&Es with a better understanding of the complexities driving technological decisions.

The conclusions emphasized the crucial nature of digital and technology literacy as a digitalization prerequisite. Therefore, the government should consider providing relevant and adequate assistance to Malaysian manufacturing SMEs. The study could catalyze the Malaysian government agencies to improve assistance to SMEs concerning technology adoption.

The government must be able to facilitate Malaysian manufacturing E&Es technology usage. Understanding the factors that influence technology adoption allows the government to offer or provide incentives, training, or information in crucial areas of Malaysian manufacturing E&Es and SMEs to stimulate digital technology adoption.

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-Dr. AJayandaran A/L Arumugam carried out the whole study, data collection, data analysis and writeups.

-Dr. Hamed Khazaei carried out the SEM and the statistical analysis and evaluated the whole process.

-Dr. Amiya Bhaumik critically evaluated the whole process, supervised, organized and executed the research gap, problem statement and the implications.

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