Environment and Social Psychology (2025) Volume 10 Issue 3 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i3.3435 2424-7979 (P)

RESEARCH ARTICLE

Relative advantage, technology innovativeness: Digital transformation acceptance attitude and employee creativity

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ABSTRACT

With the advent of the global digital and intelligent era, the independent innovation of enterprise employees plays an irreplaceable role in helping Chinese enterprises establish a new competitive edge in the global market. Employee creativity is embodied in cultivating and enhancing employees' innovative abilities. Implementing digital transformation has become a top priority for organizations and leadership. This study examines the relationship between digital leadership and employee creativity based on Diffusion of Innovation (DOI) theory and Social Exchange Theory (SET).

A quantitative methodology was employed using a questionnaire survey conducted with 302 middle-management employees in the high-tech industry in Shenzhen, Guangdong, China. This study utilizes a correlational design, focusing on assessing the strength and nature of relationships between variables. It addresses the research gap concerning the relationship between employees' attitudes toward digital transformation and their creativity. The study also highlights the theoretical and practical implications of technological innovation, employees' acceptance of digital transformation, and digital leadership in fostering creativity within organizations.

The findings reveal that (a) relative advantage and technological innovativeness positively influence digital transformation acceptance attitude (DA); (b) DA mediates the relationship between relative advantage, technological innovativeness, and employee creativity; (c) digital leadership positively moderates the relationship between relative advantage, technological innovativeness, and DA; and (d) DA positively affects employee creativity. These findings elucidate the mechanisms through which relative advantage and technological innovativeness affect employee creativity and expand the literature on the antecedents of employee creativity. The paper discusses practical implications and suggestions for future research.

Keywords: employee creativity; digital transformation; digital leadership; relative advantage; technology innovativeness

1. Introduction

China has emerged as a global manufacturing powerhouse, with its manufacturing value-added accounting for approximately 30% of the global share, ranking first globally for 14 consecutive years [34] However, as labor costs gradually increase, labor-intensive mass production will no longer be a sustainable strategy for continued economic growth. Instead, fostering innovation within enterprises and stimulating creativity among the workforce are critical for future expansion[54]. The high-tech industry, as the most

ARTICLE INFO
Received: 08 February 2025| Accepted: 13 February 2025 | Available online: 23 March 2025

CITATION
Xu XQ, Zainal SRBM. Relative advantage, technology innovativeness: Digital transformation acceptance attitude and employee creativity. *Environment and Social Psychology* 2025; 10(3): 3435. doi:10.59429/esp.v10i3.3435

important manufacturing sector, serves as the backbone of China's economy [84].

High technology, which encompasses advanced knowledge gained through rigorous research and development, is recognized as a fundamental driver of innovation and national economic growth[12]. In 2023, the total annual operating revenue of Sci-Tech Innovation Board companies reached nearly 1.4 trillion yuan, marking a 4.7% increase from the previous year, with net profits totaling 75.96 billion yuan [11]. Cultivating employee creativity is the first step in enhancing their innovative capacities and achieving enterprise-level innovation[41]. Strengthening the innovation capacity of high-tech industries is essential for China's economic future, and enhancing the creativity of industry professionals is pivotal to driving innovation in these industries.

The role of technological innovation has become increasingly prominent during the Fourth Industrial Revolution, particularly with the rapid development of technologies such as artificial intelligence, biotechnology, energy storage, and quantum computing. Innovation has accelerated at an unprecedented pace[9]. Furthermore, countries have improved citizens' economic welfare through effective technological innovation [74]. Differences in income disparity among nations are largely influenced by the level of emphasis placed on technological innovation[9]. Technological innovation significantly impacts the marginal output of physical capital, playing a vital role in both developed and developing economies[81].

There is growing evidence that employee creativity, defined as the generation of novel and useful ideas related to an organization's products, services, practices, or procedures, is essential for organizations to adapt to rapidly changing markets and remain competitive[3,50,55].

Employee creativity has garnered considerable attention from both researchers and practitioners. The existing literature is divided into two streams: one focuses on individual creativity while neglecting group-level contextual influences, and the other examines group creativity while overlooking individual-level factors. The interactions between individuals, innovation mechanisms, and outcomes of team-level innovation remain underexplored. For example, creativity requires individuals to contribute abilities, skills, and willingness to collaborate[86]. This study analyzes the antecedents of employee creativity from an individual perspective. Existing research suggests that digital technologies not only initiate the digitalization process in organizations but also act as a primary driving force[79]. Similar to other strategic resources within organizations, digital transformation is seen as a new prerequisite for innovation [85]. Although some studies emphasize a positive relationship between digital transformation and innovation generation[49], others do not regard digital transformation as a new source of innovation [76]. This study addresses the research gap by considering digital transformation acceptance attitudes as a factor influencing employee creativity.

Moreover, digital transformation is critical for enhancing organizational performance, as it catalyzes creativity, reduces costs, increases revenue, improves efficiency, and fosters innovation [64]. El Sawy et al.[24] emphasize that digital leadership is essential for successful digital transformation, focusing on customer engagement, advanced technology, extensive storage capacity, and fostering a culture that supports digital transformation. The effectiveness of digital transformation is determined by digital leadership[59,82]. Furthermore, some scholars argue that from the employees' perspective, digital leadership can stimulate innovation. Eberl and Drews[21] highlighted that digital leadership styles encourage employees to remain curious and continuously expand their knowledge. This leadership style helps transform employees' attitudes and values, increasing their sense of responsibility and unleashing their innovative potential. Additionally, studies suggest that leadership behaviors that communicate a clear digital vision inspire employees to pursue that vision, promoting innovative behaviors. Thus, the impact of digital leadership on digital transformation

and employee creativity requires further investigation, as it has not yet received comprehensive attention from industry practitioners.

Individuals with a positive attitude toward digital transformation initiatives are more likely to participate in such initiatives. Previous studies have shown that the lack of a technology acceptance plan is a critical factor in business failure, whereas an effective strategy is seen as a catalyst for success [20,47]. However, few studies in the literature have examined digital transformation acceptance as a key micro-level predictor of employee creativity. Therefore, given the widespread implementation of digital transformation across various business sectors and the importance of employee creativity, it is crucial to study the impact of digital transformation acceptance attitudes on employee creativity, including the timing and manner of this influence. This research will delve into these issues to leverage digital transformation acceptance attitudes to enhance the creativity of employees in China's high-tech companies.

2. Literature review

2.1. Definition of digital transformation

Digital transformation is fundamentally an innovation-centric process. Digital transformation may unlock the innovative potential of firms and propel advancements in green technologies, products, and services by introducing new technologies, processes, and ideas [8]. Digital transformation optimises organisational structure, culture and business strategy[78] by promoting the combination of individuals and technology [1,60].

However, employee digital transformation is a concrete manifestation of human digital development in the workplace, where employees achieve digital development through digital transformation. Moreover, Vial [79] emphasises that digital transformation should encompass "the broader context of individuals, organisations, and societies" and that the definition should clearly state the unit of analysis, the scope of transformation, the transformation process, and the expected outcomes. Digital transformation involves both organisational and individual entities. Therefore, within an organisational framework, the process by which employees trigger significant changes in their attributes and improve their capabilities through integrating information, computing, communication and connectivity technologies is called employee digital transformation.

The digital transformation of the workforce emphasises the dependence of transformation on information and technology, the triggering of significant changes in employee attributes, and the enhancement of individual employee competencies. Employee digital transformation implies using digital tools in work activities and enhancing personal competencies and changes in work activities and processes [72].

2.2. Definition of employee creativity

The study of creativity has a long history, and scholars have different opinions. Different scholars have different opinions on the concept of creativity, and Rhodes[68] summarised the 4P elements of creativity by analysing and summarising more than 40 definitions of creativity, i.e., the creator (person), the process of creativity, the environment of creativity (place, also known as the press), and the result of creativity (product). It can be concluded from the above concepts: first, the basis of creativity is the idea or idea, that is, the thinking of the problem; second, the core of creativity is novelty or usefulness, that is, through comparison or verification can better understand or solve the problem. Third, creativity is a dynamic process that includes the cognitive characteristics of input-processing-output and the reciprocity between the person and the environment; Woodman et al[83]. suggest that creativity is a personal trait that can be interpreted in

terms of individual personality traits. Creativity plays a decisive role in the performance of an organisation [75].

In addition, it is a critical factor in organisational productivity and an area that scholars have widely studied. In organisations, employee creativity involves producing original and practical ideas related to products, services, and work processes[4]. Oldham and Cummings[62] argued that employee creativity must satisfy two conditions: creative pioneering and beneficial or relevant to the organisation. Employee creativity results from the interaction between individual and situational factors, leading to the development of innovative and practical ideas, services, programs, and products. Employee creativity results from the interaction between individual and situational factors, leading to the development of innovative and practical ideas, services, programs, and products[44,73]. It is formed due to the action of multiple elements of individual traits, cognitive abilities, and social environment [44]. Research indicates that employee creativity fosters product innovation, enhances customer satisfaction, and contributes to a lasting competitive edge for organisations [35,56]. In the era of information explosion, employees need to fully mobilise their initiative to stimulate creativity and seek breakthroughs. In the era of digitalisation and intelligence, employee creativity has become an important force to promote organisational innovation.

2.3. Theoretical model

2.3.1. Diffusion of innovations theory

Rogers and Williams describe diffusion as the spread of innovation over time among members of a social system through specific channels. It is a particular communication style connected to concepts seen as novel[70]. Four components of innovation dissemination are included in this definition: innovation, communication channel, time, and social system. The first component, innovation, is a concept, method, or item that a person or other adopter perceives as novel. The channels of communication, or the second element, are how information is transferred from one person to another.

Innovators, early adopters, early majority, late majority, and laggards are the principal participants in the DOI framework [69]. Those who take chances and are the first to try new things are considered innovators. Those eager to experiment with new technologies and determine their utility are known as early adopters. Early Masses are members of the general public who set the path for innovations mainstream society uses. Individuals who integrate innovations into their daily lives and belong to the broader public are known as late adopters, who follow in early adopters' footsteps. Individuals who adopt novel items and ideas later than the broader audience are laggards.

Early adopters and innovators are typically prepared to assume the risks of experimenting with novel concepts, ideas, or technologies. Conversely, laggards avoid taking chances and adhere to their methods. They will eventually become reliant on the invention in their daily life (and at work) once it gets widely accepted. They must, therefore, begin using it. According to the DOI hypothesis, a "new idea" might be any concept, technology, good or service, or behaviour.

The concept of DOI elucidates the gradual permeation of new ideas, behaviours, products, or technology throughout a population over time rather than co-occurring. Early adopters and innovators are the first to adapt, followed by the early and late majority. The last to use the innovation are the laggards.

A decision-making procedure consisting of five steps is used to accomplish diffusion. These are the five steps: appraisal, experimentation, adoption, interest, and awareness. In later iterations of his book, Rogers renamed these processes: Knowledge, Persuasion, Decision, Implementation, and Confirmation[69]. Therefore, this study explored the effect of the attitude of DA on employee creativity in Information Technology companies based on DOI.

2.3.2. Social exchange theory

Social exchange theory is considered one of the key paradigms for understanding organisational behaviour with far-reaching implications[14]. The fundamental assertion in social exchange theory is that people are self-interested in doing business and dealing with each other to facilitate their goals, which they cannot achieve alone. Consequently, self-interest and interdependence are the natural inherent characteristics of social exchange[53]. Moreover, at least two levels of exchange partners exist in organisations, which researchers differentiate as the organisational and individual levels[15]. The explanatory power of SET stems from three core ideas:(1) rules and norms of exchange, (2) the exchange of resources, and (3) the formation of relationships [14].

Exchange resource theory consists of six types of resources: (1) love, money, status, goods, information, and services. Money, which refers to any coin, currency, or token with a standard unit of exchange; (2) goods, which refers to tangible products, objects, or materials; (3) services, which are acts of labour provided in response to another person's body or possessions; (4) information, which refers to advice, opinions, guidance, and enlightenment; (5) status, which is demonstrated by speech that shows an evaluation of the other party's prestige, respect, and high or low reputation; and (6) love, which expresses emotional care [29].

3. Research design

3.1. Research variable

This study aims to investigate the effects of Technology Innovativeness and relative advantage on employee creativity in high-tech enterprises in Shenzhen, Guangdong. DA's mediating role and digital leadership's moderating role are investigated. A comparison is made between the differences in the characteristics of digital technology and existing technology regarding technological innovativeness and relative advantage. Specific details of each research variable are given below.

3.1.1. Relative advantage

Relative advantage is a criterion for comparing new technologies with traditional methods or techniques[69]. Digital technology's relative advantage is whether digital technology reduces the level of responsibility for the operation, can be used more efficiently, and is in line with the values of the user[69]. Employees are more likely to embrace digital transformation strategies if they perceive new technologies and processes as superior to existing ones in terms of efficiency, effectiveness and overall benefits. Moreover, when employees recognise the potential of digital technologies to improve work performance, productivity and competitiveness, they develop a more positive attitude towards transformation [61,63]. Comparative advantage also affects the perceived usefulness of new technologies, which strongly predicts acceptance and adoption[63].

3.1.2. Technology innovativeness

Technology innovativeness explains the technological dimension of innovation as a prerequisite for the DOI innovation decision-making process, which belongs to the stage of perception and perceived innovation characteristics. Digital technologies contain differences from previous technologies and many innovations that users can perceive as new[61]. Ram emphasises the importance of the degree of novelty that the consumer perceives. No matter how innovative the technology is, it will not be used as long as it is not felt by the user [67].

3.1.3. Digital transformation acceptance attitude

Human behaviour is shaped by behavioural intentions and actual control (including skills, abilities and environmental factors), which in turn are influenced by a variety of factors, such as an individual's behavioural beliefs, normative beliefs, control beliefs, and personal, social and informational factors[28]. Perceived usefulness and ease of use of digital technology in organisations impact employees' attitudes of acceptance and engagement with digital technology [16]. Therefore, we considered in this study that the acceptance attitude of digital transformation was affected by relative advantage and technology innovativeness.

Fishbein and Ajzen[27] state that intention to act determines the actual action, while an individual's attitude (awareness) towards the behaviour influences the intention to act. Davis explains that the actual application of new technology depends on beliefs and intention to use it and that these beliefs influence the level of involvement of a person or organisation [17]. In this study, acceptance attitudes were considered as variables mediating employee creativity.

3.2. Hypothesis development

Employees are more likely to embrace digital transformation strategies if they perceive new technologies and processes as superior to existing ones in terms of efficiency, effectiveness and overall benefits [61,63]. Moreover, when employees recognise the potential of digital technologies to improve work performance, productivity and competitiveness, they develop a more positive attitude towards transformation[61,63]. Comparative advantage also affects the perceived usefulness of new technologies, which strongly predicts acceptance and adoption [63]. Therefore, this leads to the following hypothesis:

Hypothesis 1. Relative advantage is positively related to DA.

Technological innovativeness explains the technological dimension of innovation as a prerequisite for the DOI innovation decision-making process, which belongs to the stage of perception and perceived innovation characteristics. Ram emphasises the importance of the degree of novelty that the consumer perceives[67]. Digital technologies contain differences from previous technologies and many innovations that users can perceive as new[61]. DOI suggests that the process of employee technology adoption unfolds in five stages: knowledge, persuasion, decision, implementation, and confirmation. Technologies with higher levels of innovativeness tend to be more appealing at each of these stages. Initially, innovative technologies capture employees' attention through their novelty and uniqueness, prompting them to further explore the technology. During the "persuasion" stage, employees assess the advantages and disadvantages of the technology, with highly innovative technologies often perceived as having greater potential for growth and utility, thereby encouraging employees to make positive decisions regarding adoption. Subsequently, employees gradually implement and confirm the effectiveness of the technology, a process closely linked to the level of technological innovativeness. For example, Venkatesh[77] found that more innovative technologies are more likely to foster positive employee attitudes toward technology adoption. According to the DOI, the observability of technology refers to the extent to which the outcomes of using new technologies are visible to employees. Highly innovative technologies are typically better at demonstrating their novelty and results, thus enhancing their observability. When employees witness the tangible effects and practical applications of new technologies, they are more likely to develop a positive attitude toward the technology. This attitude not only boosts employees' willingness to adopt the technology but also facilitates the broader implementation of digital transformation. As Karahanna et al., [48] noted, technologies with strong innovation characteristics enhance employees' perception of positive outcomes through their visibility, thereby promoting the acceptance of digital transformation. Therefore, this leads to the following hypothesis:

Hypothesis 2. Technology innovativeness is positively related to DA.

Effective digital technologies can appeal to outside investors, encouraging investment in research and development [6]. Furthermore, digital technology promotes adaptability and creativity in companies, and both the recognition of new ideas and investment in research and development can impact the level of innovation produced by enterprises [32.51]. Individual creativity arises from the interplay of personal attributes and external influences. Individual attitudes and actions are influenced by the interplay between the individual and the environment and cannot be solely attributed to the individual or the environment alone[22]. DA arises from the collective influence of both the employee and the organisational environment. The organisational atmosphere will exhibit greater creativity when the values align with the required level of competence. Combining the individual employee's efforts in digital transformation with the company's conducive climate for digital transformation, including digital leadership, will enhance employee creativity. Moreover, DOI posits that more innovative technologies are more readily adopted by employees with creative potential, and such acceptance attitudes can inspire employees to explore creative applications of new technologies[69]. Employees' acceptance of digital transformation can be explained through Social Exchange Theory as a response to organizational support. When employees perceive that the organization provides adequate support and resources during the process of digital transformation, they tend to develop a positive attitude towards these changes, which in turn leads to higher levels of creativity. For example, Cropanzano and Mitchell [14] suggest that employees respond to organizational support through social exchange mechanisms by actively engaging in technological changes and utilizing new technologies for innovation and creative work. This reciprocal relationship motivates employees to reciprocate organizational support with enhanced creativity. Therefore, we propose as follows:

Hypothesis 3. DA have a positive impact on employee creativity.

Digital technologies are considered to be highly innovative. Technological innovativeness elucidates innovation at the technological level as a prerequisite for the innovation decision-making process of the DOI [61]. DA and employee creativity are also considered diffusions of innovation, so technological innovativeness is considered to have an influential effect on DA and employee creativity. Relative advantage is positively correlated with DA; the more significant the relative advantage, the higher the DA [61]. In addition, digital leadership can encourage employees to experiment with new technologies and consider new ways of solving problems[19]. Digital leadership can create a successful digital workplace to promote employee innovation [87]. The stronger the relative advantage of technology, the more desire and motivation employees have to adopt digital transformation, leading to increased psychological acceptance. At the same time, in conjunction with digital leaders' promotion of digital transformation, employees' creative output is enhanced when their sense of digital transformation is aligned with their workplace.

Moreover, this fit is essential to maximise the benefits of organisational digital transformation [44]. This study draws on Social Exchange Theory, which suggests that employees' behaviour in the workplace is driven by their perceived support and encouragement from leaders. Digital leadership enhances the reciprocal relationship between employees and the organization by providing technical support, resource investment, and a work environment that fosters innovation. When employees perceive the digital resources and opportunities provided by leaders, they reciprocate by increasing their creative performance. This reciprocal relationship serves as a key motivator for enhancing employee creativity. Previous research by Eisenberger et al[23]. also demonstrated that when employees perceive organizational support, they tend to respond with higher levels of creativity. Therefore, this study will test the relationship between digital

leadership, relative advantage, technology innovativeness, and DA. So, the following hypothesis is proposed. Thus, we propose:

Hypothesis 4. Digital leadership moderates the relationship between relative advantage and DA such that in the case of higher levels of digital leadership, the influence of relative advantage on DA will be more substantial.

Hypothesis 5. Digital leadership moderates the relationship between technology innovativeness and DA such that in the case of higher levels of digital leadership, the influence of technology innovativeness on DA will be more potent.

Digital technology promotes adaptability and creativity in companies, and both the recognition of new ideas and investment in research and development can impact the level of innovation produced by enterprises[32,51]. Digital technologies are considered to be highly innovative. Technological innovativeness explains innovation at the technological level as a prerequisite for the DOI's innovation decision-making process [61]. Relative advantage has been shown by several empirical studies to have a positive impact on innovation acceptance[63]. Relative advantage is positively correlated with DA; the more significant the relative advantage, the higher the DA [61]. The stronger the relative advantage of technology, the more desire and motivation employees have to adopt digital transformation, leading to increased psychological acceptance. Digital transformation is often seen as a catalyst for innovation, especially for technology-based firms [42]. Research by Akhtar et al. found the importance of IT capabilities as a strategic resource, and the results suggest that IT adoption benefits innovation performance[2].

Rogers' DOI suggests that highly innovative technologies are more likely to be adopted by employees with creative potential, and such acceptance attitudes can stimulate employees to explore the creative applications of new technologies[69]. In this process, the attitude toward digital transformation acts as a crucial mediating variable, helping employees draw inspiration and creativity from technological innovativeness. Digital leadership can enhance employees' perceived competence in their work by providing innovative technological tools, open innovation platforms, and technical training. According to Social Exchange Theory, employees perceive these leadership behaviours as offering them value and support, which in turn strengthens their sense of responsibility and creativity. For instance, the study by Eberl and Drews[21] found that digital leadership fosters a reciprocal relationship that stimulates employees' creative potential. In the context of digital transformation, leaders create supportive, innovative environments that enhance employees' creative performance. Such leadership behaviour can be viewed as a value exchange, where employees reciprocate by contributing higher levels of creativity to the organization. So, the following hypothesis is proposed.

Hypothesis 6. DA positively mediate between the relationship of relative advantage and employee creativity.

Hypothesis 7. DA positively mediate between the relationship of technology innovativeness and employee creativity.

Digital technologies are considered high in their technological innovativeness. Technological innovativeness explains innovation at the technological level as a prerequisite for the DOI's innovation decision-making process. DA and employee creativity are also considered diffusions of innovation, so according to DOI, technological innovativeness is considered to have an influential effect on DA and employee creativity. Relative advantage is positively correlated with DA; the more significant the relative advantage, the higher the DA [61]. The stronger the relative advantage of the technology, the more desire and motivation employees have to adopt digital transformation, leading to increased psychological acceptance. Digital leadership can motivate staff to explore new technology and contemplate innovative problem-solving approaches [19]. Digital leadership can establish an effective digital workplace that fosters employee

innovation [87]. Relative advantage or technological innovativeness with digital leadership for the promotion of digital transformation, employees' sense of digital transformation is aligned with the work environment, and their creative output is enhanced. This fit is critical to maximise the benefits of organisational digital transformation [52]. No one has tested the moderating effect of digital leadership on the relationship between Relative advantage, technology innovativeness and DA. Therefore, this study will test the relationship between digital leadership, relative advantage, technology innovativeness, and DA.

Figure 1 shows a visual depiction of the research model.

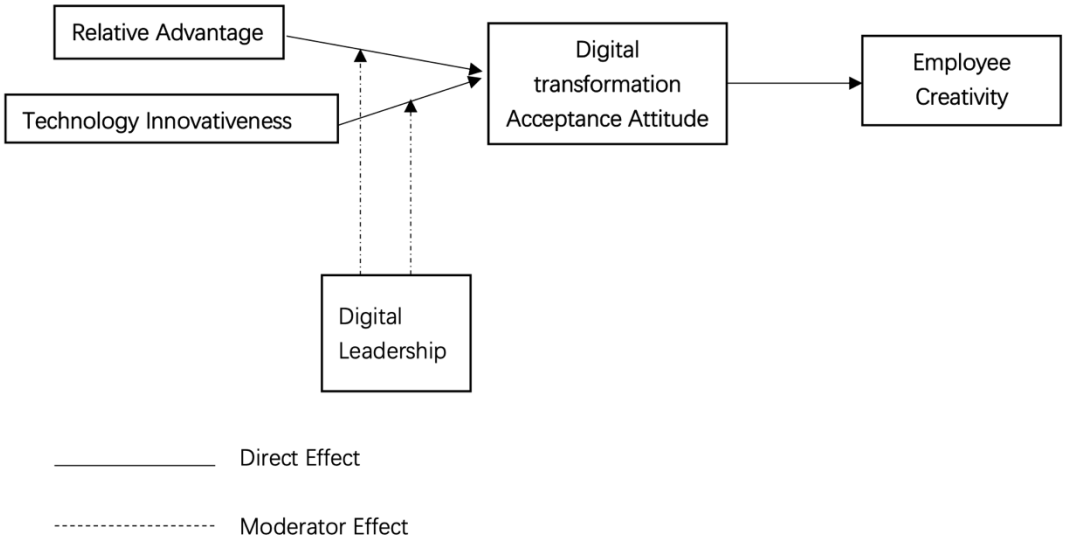

Figure 1. Research model.

4. Research methodology

4.1. Measurement development

Relative Advantage was adopted from Son et al., Moore and Benbasat and Erjavec et al. Technology innovativeness was adopted by Son et al. and Rogers. Technology innovativeness was adopted by Son et al. and Rogers. DA was adopted from Son. All scale items were initially created in English and subsequently translated into Chinese, with all items assessed using a seven-point Likert scale. All scale items were measured on a seven-point Likert scale, where 7 means strongly agree and 1 means strongly disagree.

Table 1. Operational definitions and measurements.

Factor	Measurement	Related Studies
Construct 1: Relative advantage	Digital technology is likely to be more useful than existing technology.	(Oh et al., 2022)
	Using digital technology will be more convenient than using existing technology.	(Moore & Benbasat, 1991)
	Digital technology is more reliable compared to existing technology.	(Erjavec et al., 2018)
	Digital technology will be better compared to existing technology.	(Oh et al., 2022)
Construct 2: Technological innovativeness	I think digital technology is made with the latest technology.	(Oh et al., 2022)
	Digital technology is innovative.	(Oh et al., 2022)

Factor	Measurement	Related Studies
	Digital technology is original, creative, and novel.	(Oh et al., 2022)
	Digital technology differs greatly from existing technology.	(Rogers, 1995)
Construct 3: Digital transformation acceptance Attitude (DA)	I think positively about using products or services with digital technology applied.	(Oh et al., 2022)
	I feel good about using products or services with digital technology.	(Oh et al., 2022)
	I am actively in favour of the use of products or services for which digital technology is applied.	(Oh et al., 2022)
Construct 4: Digital leadership	The leaders in our company recognise the network character by identifying the competencies and contacts of individual employees.	(Meier et al., 2017)
	In our firm, leaders develop trust in the employees.	(Meier et al., 2017)
	In our firm, leaders provide necessary information to employees.	(Meier et al., 2017)
	In our firm, leaders act as learning guides and coaches.	(Meier et al., 2017)
	Leaders are open to critique, feedback and new ideas.	(Meier et al., 2017)
	Leaders have high confidence in their capabilities because of the fast-changing environment.	(Meier et al., 2017)
Construct 5: Creativity	I suggest many creative ideas that might improve working conditions at the organisation.	(Baer & Oldham, 2006)
	I often come up with creative solutions to problems at work.	(Baer & Oldham, 2006)
	I suggest new ways of performing work tasks.	(Baer & Oldham, 2006)
	I am a good source of creative ideas.	(Baer & Oldham, 2006)

Table 1. (*Continued*)

4.2. Participants and data collection

The questionnaire for this study was conducted online between September 2024 and October 2024, targeting middle management employees in the high-tech industry in Shenzhen, Guangdong, China. An initial survey of 302 employees was conducted to determine whether the respondents had some level of understanding of the exact concept of digital transformation. Questionnaires were then distributed to the respondents. Following the guidelines[13], the following sample sizes for factor analysis are described: 50 as very poor, 100 as poor, 300 as good, 500 as very good and 1,000 as excellent.

So in this research, a total of 410 questionnaires were gathered, and those completed in under 120 seconds or containing missing items were excluded. Consequently, 302 questionnaires were utilised for the analysis.

Table 2 presents the frequency analysis findings that assessed the survey participants' general features via fundamental data analysis.

Table 2. Respondents' demographics (N =302).

	N	%
Gender		
Female	112	37
Male	190	63

	N	%
Age		
Under 30	0	
30–39	137	45
40–49	98	32
50+	67	22
Academic Qualification		
Senior high school / Technical secondary school or below	32	11
Junior college	92	31
Bachelor Degree	115	38
Postgraduate Degree	63	21
Position		
Senior director	58	19
director	52	17
Senior manager	47	16
manager	46	15
Chief officer	50	17
Staff	49	16
Department		
HR	55	18
R&D	53	18
Marketing	64	21
Supply Chain	68	23
IT	62	21
Working experience		
3 – 5 years	13	4
5 – 10 years	70	23
More than 10 years	219	73

Table 2. (*Continued*)

The research model was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through the Smart PLS 3.0 software. The reason for selecting this method is that it is suitable for analyzing non-normally distributed data and can provide reliable results even with relatively small sample sizes [37]. Furthermore, PLS-SEM is appropriate for conducting regression analyses with mediators [66]. Meanwhile, PLS-SEM applies to both complex and simple research models, and it does not require assumptions about the normality of the data [26].

5. Data analysis

5.1. Factor analysis and reliability

Variables were analysed in this study using SPSS 27.0. PLS-SEM for SmartPLS was used with a two-step assessment model and Hair and Sarste digital transformation's structural model [37]. Hair et al.[26] stated

that external loadings should be higher than 0.708. The reliability of the scale was assessed by Cronbach's Alpha; acceptable ranges for CA are ≥0.7 and <0.950; all values in this study were within the threshold[37]. For the AVE, acceptable values are 0.50 and higher [38]. The recommended value for CR is 0.7 or higher [37]. We assessed discriminant validity with SmartPLS 4 software. Discriminant validity refers to "the extent to which a specific latent variable is distinct from other latent variables" [29]. We employed the HTMT approach to evaluate discriminant validity. The HTMT values were below the suggested threshold of 0.90 [43]. Table 4 presents the HTMT ratios. All upper boundaries of the confidence intervals remained below a value of 1. This signifies that the HTMT ratios markedly deviate from 1, confirming the construct's discriminant validity [31].

Table 3. EFA results for the relative advantage, IC construct.

Dimension	**Code**	**Mean**	**SD**	**Indicator loading**	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**AVE**	**Cronbach's alpha**
Relative Advantage	RA				0.946	0.945	0.811	0.922
Item 1	RA_1	3.03	1.957	0.960				
Item 2	RA_2	2.98	1.931	0.863				
Item 3	RA_3	3.01	1.925	0.872				
Item 4	RA_4	3.07	1.958	0.905				
Technology Innovativeness	TI				0.936	0.949	0.822	0.928
Item 1	TI_1	3.26	1.943	0.897				
Item 2	TI_2	3.29	2.020	0.903				
Item 3	TI_3	3.27	1.962	0.895				
Item 4	TI_4	3.25	1.988	0.932				
Digital leadership	DL				0.941	0.950	0.760	0.937
Item 1	DL_1	3.00	1.926	0.900				
Item 2	DL_2	3.06	2.001	0.863				
Item 3	DL_3	3.02	1.962	0.849				
Item 4	DL_4	3.06	1.968	0.862				
Item 5	DL_5	3.09	2.051	0.864				
Item 6	DL_6	2.98	1.931	0.892				
Digital transformation acceptance attitude	DA				0.868	0.918	0.79	0.867
Item 1	DA_1	3.15	1.921	0.887				
Item 2	DA_2	3.16	1.972	0.878				
Item 3	DA_3	3.21	2.010	0.901				
Employee creativity	EC				0.929	0.946	0.815	0.925
Item 1	EC_1	3.02	2.001	0.896				
Item 2	EC_2	3.00	1.997	0.898				
Item 3	EC_3	3.02	2.030	0.930				
Item 4	EC_4	3.01	2.018	0.888				

Table3. (*Continued*)

Table 4. Discriminant validity.

	DA	DL	EC	RA	TI
DA					
DL	0.448				
EC	0.350	0.398			
RA	0.440	0.352	0.352		
TI	0.347	0.271	0.306	0.322	

Source(s): *Authors own creation*

R square. The R^2 number ranges from 0 to 1.R2 values ranging from 0.13 to 0.67 should be classified as strong, moderate, and low, respectively [40]. The R^2 value is the extent to which the independent variables in a simple regression explain changes in the predictor variables. In this study, the values of R^2 are 0. 311 and 0.099, which shows a significant effect (**Table 5**). The R2 value of 0.099 indicates a 9.9% change in the employees' creativity.

Table 5. Assessment of R-square.

	R^2
DA	0.311
EC	0.099

Source(s): Authors own creation

5.2. Technical statistical and correlation analysis

In order to validate the research assumptions of the structural model, the path coefficients were analysed using SmartPLS 4 and estimated using the bootstrap resampling method[39]. In this study, variance inflation factors (VIFs) were calculated for all variables except interaction terms to determine the existence of multicollinearity [46]. The results are shown in **Table 6**. In addition, the maximum VIF value of 5.865 is well below the threshold value of 10, which indicates that multicollinearity is not an issue in this study [36].

5.3. Hypothesis test

The PLS-SEM bootstrapping method statistically established the structural model coefficients that denote the proposed relationships.

5.3.1. Direct effects

The results show a significant positive relationship between relative advantage and digital transformation acceptance attitude (β=0.209, t= 3.793, p=0.000). Hence, H1 is supported. The results show a significant positive relationship between technology innovativeness and digital transformation acceptance attitude (β=0.140, t=2.477, p=0.013). Hence, H2 is supported. The results also show a significant positive relationship between DA and employee creativity (β=0.314, t=5.597, p=0.000). Hence, H3 is supported (see **Table 5**).

5.3.2. Moderating effect

A moderation test was performed to assess the impact of the moderator variable (digital leadership) on the direction or intensity of the connection between the independent variables (relative advantage, technology innovativeness) and the dependent variable (DA). The results show that the moderating role of digital leadership between relative advantage and DA is significant (β=0.117, t=2.350, p=0.019). Hence, H4

is supported. The results show that the moderating role of digital leadership between technology innovativeness and DA is significant (β=0.132, t=2.694, p=0.007). Hence, H5 is supported (see **Table 6**).

5.3.3. Mediating effects

We conducted multiple analyses to test for mediating effects. By adding DA as a mediator variable, the association between relative advantage and employee creativity remained significant (β = 0.037, t = 2.234, p = 0.026, respectively). Technology innovativeness and employee creativity were also significant (β = 0.025, t = 1.795, p = 0.085, respectively). Hence, hypothesis 6 and hypothesis 7 are supported (see **Table 6**).

Table 6. Table path coefficient and hypotheses testing.

Hypothesis	Relationship	Path coefficient	SD	P	t-value	Decision
H1	Rel adv→ DA	0.209	0.055	0.000	3.793	Supported
H2	Tech Inov→ DA	0.140	0.056	0.013	2.477	Supported
H3	DA→ employee creativity	0.314	0.056	0.000	5.597	Supported
H4	Rel adv *DL→ DA	0.117	0.050	0.007	2.350	Supported
H5	Tech Innov *DL→ DA	0.132	0.049	0.019	2.694	Supported
H6	Rel adv→ DA→ employee creativity		0.022	0.003	2.934	Supported
H7	Tech Inov→ DA→ employee creativity		0.021	0.035	2.113	Supported

6. Discussion

This study aims to examine whether and how individual innovative characteristics, as an important personal difference, influence employee creativity. Drawing on SET, the study investigates the impact of digital leadership on employee creativity. The data analysis of 302 middle-management employees from high-tech companies in Shenzhen supports all the proposed hypotheses.

In recent years, there has been increasing academic attention on employee creativity (e.g., El Sawy et al. [7,10,18,24,33], yet few studies have focused on the relationship between digital transformation and employee creativity. Based on DOI and SET, this study explores the relationship between digital transformation and employee creativity. The empirical results support the proposed research model, with key findings as follows: First, both relative advantage and technology innovativeness show a positive correlation with DA. The results are consistent with previous studies, which suggest that relative advantage and technology innovativeness play significant roles in promoting employee acceptance of digital transformation[71].Furthermore, another finding indicates a positive correlation between employees' digital transformation acceptance attitude and innovation generation within the organization. A positive attitude toward digital transformation helps employees better understand and utilize new technologies, thus stimulating their creativity. This attitude allows employees to adjust their work more flexibly in a digital environment, enhancing their innovation potential [48].

Peng and Tao [64] highlighted that digital transformation drives organizational development by improving efficiency, reducing costs, and fostering innovation. Employees' technology acceptance strategies are critical, as the lack of such plans often leads to organizational failure. In contrast, effective acceptance strategies catalyze success, driving the realization of creative thinking among employees.

Another key finding of this study pertains to the important relationship between DA and employee creativity. These results are consistent with previous research, with some studies indicating a positive correlation between employees' acceptance of digital transformation and innovation generation within

organizations. Kastelli et al. [49] emphasized that a positive attitude toward digital transformation helps employees understand and apply new technologies, thereby fostering creativity. This attitude enables employees to adapt their work more flexibly in a digital environment, thus enhancing their innovation potential.

Incorporating DA as a mediating variable in the overall model is significant because it expands the knowledge base and enhances our understanding of how core constructs influence employee creativity. This aligns with the findings of Venkatesh et al.'s [77] technology acceptance model and Rogers' DOI [69]. The results confirm the mediating role of DA in transforming relative advantage and technology innovativeness into concrete expressions of employee creativity. According to Venkatesh et al.'s[77] technology acceptance model, when new technologies provide significant performance advantages, employees are more likely to enhance their creative thinking and problem-solving abilities by accepting these technologies. Employees' acceptance of digital transformation serves as a critical mediator in this relationship, where relative advantage enhances employees' technology acceptance attitude, which in turn fosters their creativity. When employees perceive a high level of technological innovativeness, their curiosity and willingness to adopt the technology increase. Research indicates that this positive acceptance attitude helps employees demonstrate greater creativity in their work.

In addition to these direct relationships, the findings also emphasize the important moderating role of digital leadership in the relationship between relative advantage, technology innovativeness, and DA. Eberl and Drews[21] noted that digital leadership encourages employees to remain curious and continuously expand their knowledge, which not only enhances their innovation capabilities but also fosters creative behaviours in the workplace. Through clear communication of a digital vision, leaders can motivate employees to take innovative actions, thereby promoting the organization's creative development. This study draws on SET, which suggests that employees' behaviour in the workplace is driven by their perceived support and encouragement from leaders. Digital leadership strengthens the reciprocal relationship between employees and the organization by providing technical support, resource investment, and an environment conducive to innovation. When employees perceive the digital resources and opportunities provided by leaders, they reciprocate by enhancing their work creativity. This reciprocal relationship serves as a key driver for the improvement of employee creativity. Previous research by Eisenberger et al. [23] also demonstrated that when employees perceive organizational support, they tend to reciprocate with higher levels of creativity.

6.1. Theoretical contributions

From the theoretical perspective, researchers can add to the existing literature and theories on the relationship between DA and employee creativity. Few studies have used DA as a key prerequisite for predicting employee creativity at the micro level. Eventually, no one has tested the moderating effect of digital leadership on the relationship between RA, TI and DA. Consequently, considering the extensive implementation of digital transformation across several business sectors and the significance of employee creativity, it is essential to investigate the timing and manner in which digital adoption influences employee creativity. This study developed a theoretical model to examine the effect of DA on employee creativity, thereby addressing the existing theoretical gap.

6.2. Practical contributions

The evolution of domestic industries has shifted from agriculture to an emphasis on manufacturing and service sectors. Through sustained investment in research and development and the advancement of technology, manufacturing has evolved into a technology-intensive high-tech sector. Reserving excellent

professionals and specialised R&D and innovation capabilities has always been a key challenge for the high-tech industry [45].

The research intends to study employee creativity directed by the relative advantage and technology innovativeness of new technology through the DA of employees. The results from the present study may be helpful for the Chief Information Officer or other positions in the organisation, as they relate to digital transformation efforts, in understanding employee creativity. The findings from this study may provide new insights into effective digital transformation practices that could help leaders of other business sectors, in addition to high-tech companies, improve employee creativity and increase efficacy and profitability. The study can also assist the researchers in comprehending the association between relative advantage and technology innovativeness of digital technology, DA, digital leadership, and employee creativity. The results may further highlight the need for additional research on factors evaluated in this study and indicate the development and empirical testing of the mechanism by which relative advantage and technology innovativeness of digital technology, digital leadership, and DA affect employee creativity.

The results of this study provide implementation recommendations for companies to embark on the implementation of digital transformation programs for their employees to improve their creativity and ultimately achieve the goal of improving the quality of the workforce and product innovation research and development capabilities in high-tech industries.

Additionally, in China, as most of these studies have been conducted in the Beijing and Shanghai regions, the present study will fill in the gap by contributing knowledge from the high-tech companies in Shenzhen. According to the report of People's Daily, Shenzhen has the most significant number of high-tech companies per square unit in China (the highest density) [67].

The result of the present study might help those in charge of transforming their organisation with new technology by suggesting the determinant factors for successful digital transformation, future researchers, high-tech companies' employees, and leaders to know how to increase the creativity of employees by boosting their DA, which in turn will increase the innovation capacity of their organisations. Moreover, regions other than high-tech companies in Shenzhen can also benefit from the results of the present study, such as the high-tech companies in other cities in China or countries in Southeast Asia.

6.3. Limitations and Future Research

This study only considered individual and organisational level factors and did not consider the influence of social factors on the attitude towards digital transformation acceptance. Subsequent research should examine additional potential elements influencing digital transformation, which may encompass socially oriented notions. In addition, multi-group analyses should be used to identify differences between groups of respondents from various industries and the high-tech industry, which is the focus of this study. Alternatively, a questionnaire survey should be conducted using samples from different specific industries to conduct a follow-up study.

Conflict of interest

The authors declare no conflict of interest.

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