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STARA fight or flight: a two-wave time-lagged study of challenge and hindrance appraisal of STARA awareness on basic psychological needs and individual competitiveness productivity among hospitality employees

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ABSTRACT

The introduction of *smart technologies, artificial intelligence, robotics, and algorithms* (STARA) has changed the workforce significantly, with many concerns about its impact on employees. This study elucidates how one's appraisal of this situation would influence basic psychological needs and individual competitiveness productivity. Using a two-wave time-lagged study, data collected from 224 hospitality employees was examined using the partial least squares method structural equation modelling (PLS-SEM). Results suggested that individual appraisal towards STARA awareness has differential outcomes towards satisfying basic psychological needs. Among the three basic psychological needs, the needs for relatedness and competency were positively related to individual competitive productivity (ICP). We extend extant studies by incorporating challenge-hindrance framework and self-determination theory (SDT) in the context of the future of work involving STARA. It advances the body of knowledge in understanding a more fundamental issue of how STARA can bring out the best in employees, how STARA shapes employees' opinions and perspectives of the work they are doing, and what they should do to work alongside STARA.

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STARA; hospitality; individual competitive productivity; challenge-hindrance framework; individual competitive productivity; self-determination theory

Introduction

The recent acceleration in technological change and the shifting in societal expectations have caused a vast amount of attention on the role of *smart technologies, artificial Intelligence, robotics, and algorithms* (STARA) (Brougham & Haar, 2017; Parker & Grote, 2020). It is expected to replace approximately one-third of existing jobs (Yudiatmaja et al., 2021). At the same time, STARA are projected to handle nearly double the amount of work tasks currently performed by humans (Ding, 2022). By 2025, 85 million jobs are expected to be affected due to a shift in the distribution of labour between humans and machines (Oosthuizen, 2022). However, this transformation is also anticipated to create approximately more than 90 million new roles that are better suited to the evolving collaboration between humans, machines, and algorithms (Brougham & Haar, 2017).

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The hospitality industry is not exempt from this trend. Many hotels are leveraging smart technologies allowing guests to control room features such as lighting, temperature and entertainment systems. Social service robots with anthropomorphic features have been deployed to provide concierge and butler services (Lu et al., 2020). Smart technologies have also been used to replace high-risk tasks to reduce the chances of injury to the human workforce (Paluch et al., 2021). Algorithms such as robotic process automation are used in booking and loyalty processing, which eventually would improve efficiency, lending itself to greater consistency and a more transparent audit trail (CiGen, 2019 Huang & Vasarhelyi, 2019;). For instance, The Flyzoo Hotel, operated by the Alibaba Group in China, offers a futuristic and technologically advanced guest experience through the integration of cutting-edge technologies like an AI management system, robotics, and facial recognition (Zhang & Jin, 2023). The Shangri-La Group partnered with Tencent to develop smart hotels, leveraging technologies to enhance guest services and operational efficiency (Shangri-La, 2018). In addition to utilizing self-service kiosks and chatbots, Gree group's hotels employ internet of things (IoT) technology to maintain a pleasant indoor temperature and humidity. This not only helps control utility expenses but also promotes environmental sustainability, all while ensuring guests' comfort remains uncompromised (Gree, 2022). According to Oosthuizen (2022), the expected performance improvement in STARA dexterity and intelligence, along with lowering production costs, will continue to increase STARA's adoption rate.

Expectedly, STARA's adoption signals changes in work practices, bringing risk and uncertainty for work and workers. One of the most apparent risks would be reduced reliance on employees. Frey and Osborne (2017) have predicted that 47 percent of jobs in the United States would be made redundant by 2025 because of STARA. Another report by the World Trade Organization (WTO) argues that while technology reduces demand for specific jobs, it can create high-technology jobs that require a workforce of different skills and traits (WTO, 2017). Putting these into perspective, the pieces of literature point toward two common agreements.

First, the advent of STARA would change the workforce significantly, with many concerns about its impact on employees (Babamiri et al., 2022; Brougham & Haar, 2017; Ding, 2021; Lela & Indi, 2020). Second, while STARA would change workforce dynamics, it is unlikely to take over the whole job (Brynjolfsson et al., 2018). This point of view demonstrates that employees are learning to co-exist with STARA, where both are trying to complement each other (Paluch et al., 2021). Therefore, rather than speculating which tasks would be replaced or the extent of replacement, we argue that research should focus on addressing a more fundamental issue of how STARA could bring out the best in employees, calling into question examining how STARA shapes employees' opinions and perspective of the work they are doing, and what they should do to work alongside STARA.

While these prospects are critical, Parker and Grote (2020) have opined that the present research is overly focused on the negative outcomes of STARA, such as job burnout (Kong et al., 2021), job insecurity (Coupe, 2019), as well as turnover intentions (Ogbeibu et al., 2021). It seems that much of the research on the impact of STARA in organizations has been premised on the assumption that technology will negatively affect workers' performance and well-being, rather than encouraging them to be more efficient and productive. Given the pervasiveness of STARA, it is surprising to note that there has been little attention to the potential benefits of STARA on employees (Ding, 2021). Such a gap is a surprise because the implementation of STARA is, nonetheless, to increase employees' competitiveness through job transformation, upskilling, and streamlining job processes (Chowdhury et al., 2022). Therefore, while existing works of literature offer key insights, it is still incomplete. As the future world of work changes due to the increased adoption of emerging technologies like STARA, we argue that more proactive efforts should be put in place to examine how, why, and when STARA enhances individuals' ability to adapt to the changing trends while benefiting from it. To fill this gap in the literature, our study aims to answer the following research question: *what are the psychological mechanisms bridging STARA and individual benefit?*

To answer this question, we leverage individual competitive productivity (ICP) as a potential individual benefit that one can manifest in the workplace. According to Ding (2021, p. 2951), ICP is an

indicator of 'identifying how a firm's STARA adoption eventually drives employees' job performance on both a relative and absolute basis'. Implementing STARA-driven work applications has been acknowledged throughout the literature, including by McKinsey (2022), as a means of enhancing employee productivity, which in turn drives organizational performance. In this regard, the competitive productivity (CP) concept introduced recently offers a more nuanced and comprehensive approach towards understanding competitiveness (Hoadley, 2020). Winzar et al. (2022, p. 1) explained that CP 'contributes to the strategic management literature of competitiveness at three levels of analysis: macro (i.e. national), meso (i.e. firm/organisation), and micro (i.e. individual; manager, worker, student)'. To this end, Baumann et al. (2019) clarified that when CP is summed up at an individual level within the organization, ICP is a major contributing factor in creating the organization level CP.

This study also addressed the phenomena using the challenge-hindrance framework and the self-determination theory (SDT), which have not been examined much in the existing STARA literature (Ding, 2021). The cognitive appraisal process explains how the manifestation of one's ICP relies on a series of transmitting reactions (Baumann et al., 2019). In a given situation, an individual can appraise it from both perspectives of either a threat or a challenge (Tomaka et al., 1993). An individual who perceives a situation as a challenge would regard it as a motivating factor that brings about enthusiasm to tackle the stressor, believing that this would result in a favourable outcome (Palmwood & McBride, 2017). On the contrary, hindrance appraisal would entail anticipation of potential harm that could arise from the situation. It is not hard to see how evaluating a situation as either a challenge or threat can trigger distinct emotional responses that alter how one views the circumstance at hand, especially in the context of automated technology at the workplace.

In the same vein, no SDT-based studies have explained how STARA manifests beneficial outcomes for employees through satisfying individuals' needs. While some studies, such as Brougham and Haar (2017), suggested that STARA met employees' need for more autonomy in managing their job demands, they fell short of providing empirical support. Therefore, the present study sought to address the lacuna in the literature by approaching the issue from another perspective of needs satisfaction which would shed light on how the evaluation of STARA fulfils or frustrates employees' basic psychological needs.

In sum, this study makes several key contributions to the existing literature. First, it introduces the concept of ICP as an indicator of job performance driven by STARA adoption. Second, it contributes to the understanding of CP at macro, meso, and micro levels of analysis. Third, it bridges the gap between the challenge-hindrance framework and the SDT in the context of STARA. Last, it addresses the need for empirical support regarding the fulfilment of employees' basic psychological needs through STARA adoption. Overall, this study advances our understanding of STARA's impact on individual outcomes and the underlying psychological mechanisms.

Theoretical framework

In this study, we leveraged the challenge-hindrance framework proposed by Cavanaugh et al. (2000) to examine the phenomenon under investigation. Setting the context, work characteristics can be categorized mainly into two categories: job demands and resources. Following Demerouti and Bakker (2011), job demands, which are explained as different aspects of the job, would require physical and/or psychological (cognitive and emotional) effort and are often associated with specific physiological and/or psychological costs. Concomitantly, job resources support individuals in achieving work goals and/or stimulating personal growth and development (Bakker et al., 2014). While it is expected that job demands would yield negative influences on work behaviour and resources would result in positive ones, Van den Broeck et al. (2010a) found inconsistent findings. An explanation for this inconclusive evidence is attributed to how an individual perceives it. This discussion mainly occurs within the challenge-hindrance framework, which spotlight that one can decide whether a situation is a 'challenge' or a 'hindrance' based on one's evaluation of a situation in terms of how much is at stake and how controllable it is.

A ‘challenge’ appraisal of the job situation refers to it as a potential for personal growth and rewards, while a ‘hindrance’ perspective of it is when it is seen to inhibit growth and prevent the achievement of goals (Ding, 2021; Webster et al., 2011). Studies have also found that ‘challenge’ and ‘hindrance’ are not mutually exclusive. Webster et al. (2011) have highlighted that individuals can simultaneously appraise a situation as a challenge and a hindrance. For instance, a career switch could be a stressful event that presents an opportunity for learning new skills, yet it can also be a situation for increased role complexity with unclear job demands. Based on this argument, both perspectives of ‘challenge’ and ‘hindrance’ must be considered when assessing an individual’s appraisal of a situation. Therefore, the assumption that, one, people make the same appraisal under the same circumstances and that, two, an appraisal can only lead to one of two distinctions (challenge and/or hindrance) are inconsistent with the principles of the challenge-hindrance framework. In this respect, it is only logical that this study examine the theory more directly by measuring employees’ challenge and hindrance appraisal of STARA awareness.

We also included the SDT to further examine how these perspectives affect one’s need for autonomy, relatedness and competence, and consequently affect work motivation. Scholars such as Gagne et al. (2022) indicate that the role of motivation in implementing technology at work is often overlooked. Hence, incorporating SDT in our research model offers a ‘useful multidimensional conceptualisation of motivation that can help predict these impacts’. (Gagne et al., 2022, p. 1). According to SDT, Deci and Ryan (2000) pointed out that three basic psychological needs of competence, autonomy and relatedness, must be fulfilled for motivation to manifest. Specifically, individuals must feel the need to master their environment (competence). Besides, individuals’ need for control over their actions (autonomy) and the ability to develop meaningful network (relatedness) must be met. Meta-analytic evidence by Van den Broeck et al. (2016) shows that satisfying these three basic psychological needs is associated with better performance, reduced burnout, more organizational commitment and reduced turnover intentions. Given the importance of these needs on work motivation and, consequently, work outcomes, researchers such as Deci et al. (2017) advocated that it is necessary to develop and promote self-determined motivation across various life domains, including work (Figure 1).

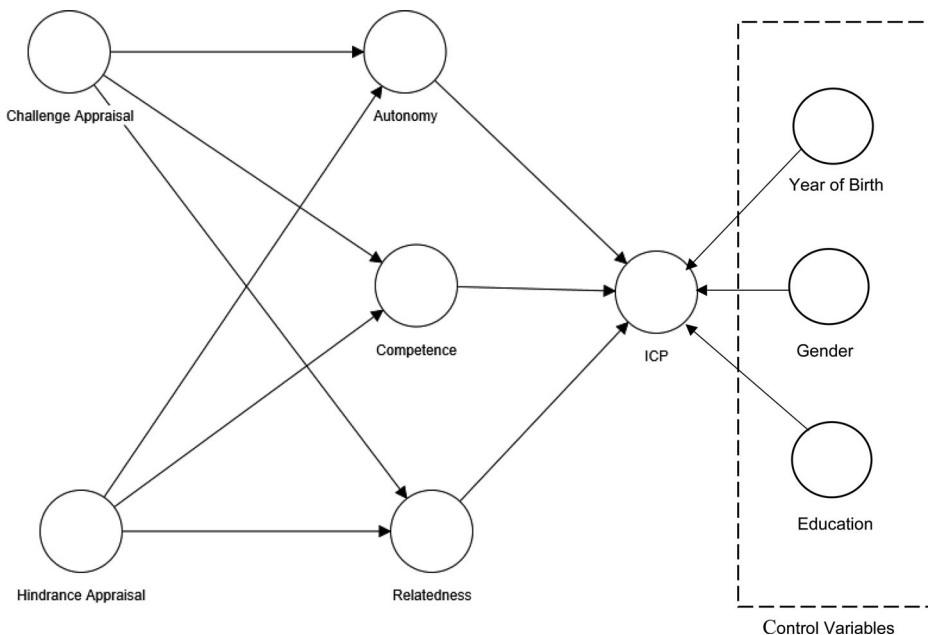


Figure 1. Conceptual model.

Hypotheses development

Challenge and hindrance appraisals of STARA awareness on three basic psychological needs

According to Brougham and Haar (2017), STARA awareness reflects employees' perspectives on how STARA could affect future job prospects. Such awareness could also suggest one's sense of insecurity about the job (Ding & Hung, 2021). To be more precise, an individual's awareness of STARA as a work stressor stimulates one's negative psychological response regarding job stability in the future. As with this proposition, studies such as Kong et al. (2021) have found that STARA awareness is associated with job burnout and turnover intention in the hospitality industry. Despite that, such claims are also debateable, given the inconsistent results (Cavanaugh et al., 2000). This could be attributed when an individual appraised a particular situation relevant to his or her well-being (Folkman et al., 1986). Putting this into perspective, employees could appraise STARA awareness as a hindrance when they suffer from work insecurity or feel stressed out over job uncertainty because STARA could take over part of their work (Mazzola & Disselhorst, 2019). It could also be a challenge as STARA awareness could trigger individuals to actively cope with this fear through learning and professional development (Li et al., 2021). Therefore, we cannot simply classify STARA into one of the two dimensions. Instead, it should be simultaneously appraised to understand one's psychological response arising from the different perspectives towards it.

To this end, Brown et al. (2021) has indicated that when individuals perceive an opportunity to develop their competencies further, it encourages them to thrive at their workplace. Scholars further argue that the psychological mechanisms explaining the manifestation of the state of thriving is to fulfil the three basic psychological needs (Autin et al., 2021; De Francisco et al., 2020). More specifically, appraising a situation as a challenge is where the presence of the stressors is deemed in proportion to the coping resources, resulting in a belief that gain or growth may occur (Brown et al., 2021). In alignment with SDT, such perception of proportionate availability of stressors and resources would lead to fulfilling the three basic psychological needs. On the other hand, the non-fulfilment of the three psychological needs would manifest when one appraises the situation to be a hindrance with the non-proportionality of resources and stressors. Hence, our hypotheses are:

H1a: Challenge appraisal toward STARA positively influences the need for autonomy.

H1b: Challenge appraisal toward STARA positively influences the need for relatedness.

H1c: Challenge appraisal toward STARA positively influences the need for competency.

H2a: Hindrance appraisal toward STARA negatively influences the need for autonomy.

H2b: Hindrance appraisal toward STARA negatively influences the need for relatedness.

H2c: Hindrance appraisal toward STARA negatively influences the need for competency.

Basic psychological needs on individual competitive productivity (ICP)

The satisfaction of the three basic psychological needs has been explained by Deci and Ryan (2008) as the key drivers for individual behaviour that predict performance and outcomes. However, research on the effects of basic psychological needs has mainly concentrated on the negative aspects of behaviour. For example, studies such as Shields et al. (2001) stated that individuals who do not experience satisfaction in their basic psychological needs are more prone to showing emotional and behavioral dysregulation when interacting with peers. Interestingly, only a limited number of studies have explored how basic psychological needs affect positive behaviors, such as ICP (Tian et al., 2018).

As previously alluded, ICP is a concept introduced by Baumann et al. (2019), combining concepts of competitiveness and productivity at an individual level. In essence, ICP reflects a change in the paradigm of having an 'attitude and behaviour directed at outperforming the competition or at least bettering one's performance through pragmatism' (Baumann et al., 2021). Competitiveness and productivity research in business disciplines is not new. For instance, Haque (2021)'s cross-sectional study showed that basic psychological needs positively influence work-unit productivity. However, it should be noted that the study analysed only work-unit productivity as an outcome. Haque (2021) espoused that other productivity outcomes should be considered for future studies.

Along this line of argument, Baumann et al. (2019) opined that this area warrants ongoing investigation because of the changing business landscape. For one, the introduction of STARA changes the nature of the workplace and the interactions between employees. Following Gagne et al. (2022) arguments, understanding how fulfilment or non-fulfilment of basic psychological needs influence one's productivity in the future of work environment is essential to support the effective functioning of organizations. Besides, the newly introduced CP paradigm, encapsulating both competitiveness and productivity, warrants empirical verification and theoretical probing (Baumann et al., 2021). Considering the above arguments, the following hypotheses are proposed:

H3a: The need for autonomy positively influences ICP.

H3b: The need for relatedness positively influences ICP.

H3c: The need for competency positively influences ICP.

Mediating effect of basic psychological needs

From the above review, it appears that there are relationships between STARA awareness, the basic psychological needs and ICP. It is possible that individuals who perceive STARA as a challenge would likely find their needs fulfilled, hence leading to an increment in ICP. Likewise, perceiving STARA as a hindrance would make their needs remain unfulfilled, thereby decreasing ICP. However, from our literature search, there is a dearth of research that demonstrate these relationships. For instance, Yang and Li (2021) highlighted that challenge and hindrance stressors have positive and negative effects on employees thriving at work. Another study by Khlifefat et al. (2021) found that the perspectives towards stressors had a corresponding relationship with interpersonal citizenship behaviour. For both studies, the authors attributed the phenomena to the positive psychological resources from employees' positive perspective to stressors (Khliefat et al., 2021; Yang & Li, 2021).

However, it is important to note that these studies did not provide empirical evidence supporting the postulations of such relationships. Besides, the contexts of their studies were not focused on STARA, and Tan et al. (2019a) demonstrated that applying findings obtained from studies of different contexts would yield limited outcomes. This perspective is supported by Gagne et al. (2022), who pointed out that rapid technological advances would mean that the future workplace might evolve into one where psychological needs are better fulfilled or one where they are neglected. Given the above arguments, finding ways to satisfy these needs and avoid undermining them in the workplace is essential.

H4a. Need for autonomy mediates the relationship between challenge appraisal toward STARA and ICP.

H4b. Need for relatedness mediates the relationship between challenge appraisal toward STARA and ICP.

H4c. Need for competency mediates the relationship between challenge appraisal toward STARA and ICP.

H5a. Need for autonomy mediates the relationship between hindrance appraisal toward STARA and ICP.

H5b. Need for relatedness mediates the relationship between hindrance appraisal toward STARA and ICP.

H5c. Need for competency mediates the relationship between hindrance appraisal toward STARA and ICP.

Methodology

Participants and procedure

The data was collected from hospitality employees with the help of China's leading hospitality group. Prior to data collection, an invitation letter was sent to the human resources managers requesting their permission to gather data. To ensure that only bonafide respondents participate in the survey, filtering question was set, asking if employees have experienced STARA at work. The survey form was formulated in English before translating into Mandarin and further back-translated to English. This approach ensured that the original meaning of all survey items was maintained. We further pretested the survey with two academics and industry experts where any forms of ambiguity were identified and replaced. According to Memon et al. (2017), pretesting would rectify any inadequacies, in time, before administering the instrument orally or through a questionnaire to respondents, thus reducing biases. Similar data collection approaches were adopted in prior studies including Olugbade and Karatepe (2018) and Monzani et al. (2021).

To minimize common method bias, we deployed two different surveys in our study. Specifically, we obtained the data from employees four weeks apart in two waves. During the first wave of data collection (Time 1), we distributed 300 survey questionnaires containing measurement items for both challenge and hindrance appraisals of STARA awareness, and 259 responses were received. In the second wave (Time 2), we distributed 259 survey questionnaires containing items for the three basic psychological needs and ICP. A total of 224 of the 259 responses corresponded to the survey data collected in the first wave, as verified via the use of identification codes. The final sample size is 224 with the response rate at 86.5%. This response rate was achieved through a variety of response-enhancing tactics, including ensuring confidentiality and securing strong management backing. Using the G*power technique, the minimum response rate required for an 80% power at 0.15 effect sizes is 85. With 224 responses, it has 99.9% power. Additionally, it exceeded the minimum sample size of 160 recommended by Kock and Hadaya (2018). Table 1 summarizes the respondents' profile.

Instruments

Both challenge and hindrance appraisals of STARA in the Time 1 survey were operationalized via items from Ding (2021) of four items each. Time 2 survey consisted of 21 items on basic psychological needs from Deci and Ryan (2000) and nine items on ICP adopted by Baumann et al. (2019). Responses to items in both challenge and hindrance stressors to STARA awareness and ICP were on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). At the same time, basic psychological needs were measured on a 7-point Likert scale, from 1 being not at all true to 7 being very true. Appendix 1 presents the survey items for each of the constructs.

Data analysis

Following Hair et al. (2017), the data was analysed using PLS-SEM. PLS-SEM was chosen as the analytical method as it has been found to work with small sample sizes with no distributional assumptions. Besides, PLS-SEM has been widely deployed across different contexts of studies, including technology acceptance (Tan et al., 2019b), consumer behaviour (Le et al., 2021; Tan et al., 2022c), tourism (Tan et al., 2022b; Tan et al., 2022e), entrepreneurship (Alim et al., 2022), human resource management (Tan et al., 2019a; Tan & Yeap, 2021), and education management (Tan et al., 2022a). More concretely, the analysis would involve two stages: measurement model and structural model assessment.

Table 1. Respondents' profile.

Characteristics	<i>n</i> = 224	%
<i>Gender</i>		
Male	143	63.8%
Female	81	36.2%
<i>Age</i>		
Born 1946 and before	1	0.4%
Born between 1946 and 1965	2	0.9%
Born between 1966 and 1980	42	18.8%
Born between 1981 and 1994	75	33.5%
Born 1995 and later	104	46.4%
<i>Highest Education level</i>		
Secondary and below	22	9.8%
College	59	26.3%
Bachelor's degree	81	36.2%
Master's degree	59	26.3%
Doctorate degree	3	1.3%
<i>Employment status</i>		
Having a full-time job	159	71.0%
Having a part-time job	65	29.0%

Measurement model

We would test the measurement model through convergent and discriminant analysis (Hair et al., 2017). Specifically, we would examine if the factor loading is above 0.708, Cronbach alpha (CA) is above 0.70, and the composite reliability (CR) is above 0.70. This is followed by the average variance extracted (AVE) which should be above 0.50 (Hair et al., 2017). After that, we would assess the discriminant validity using the Heterotrait-monotrait ratio (HTMT) test. Following Ringle et al. (2020, p. 1626), it is defined as 'the mean value of the indicator correlations across constructs (i.e. the heterotrait-heteromethod correlations) relative to the (geometric) mean of the average correlations of the indicators measuring the same construct'. Henseler et al. (2015) suggested that the cut-off value of HTMT should not exceed 0.85.

Structural model

According to Hair et al. (2017), the structural model assessment involves examining the path coefficients where we would be using the bootstrapping method of 5000 subsamples. Additionally, the coefficient of determination (R^2) and effect sizes to R^2 (f^2) will be examined. As Cohen (1988) elucidated, the R^2 reflects the amount of variance an exogenous construct has with an endogenous construct, where 0.02, 0.13 and 0.26 represent weak, moderate and substantial. At the same time, f^2 indicates the effect sizes that independent constructs' have in producing the R^2 values which sizes of 0.02, 0.15, and 0.35 are considered as small, medium and large.

Control variables

Having control variables in management research is a common practice as it would reduce the possibility of confounding results that restricts the model's explanatory power (Tan & Yeap, 2021). For one, many scholars, such as Perchtold et al. (2019) have opined that men and women have different cognitive reappraisal strategies towards a similar event. Their opinions were grounded on seminal work by Ptacek et al. (1992) where their study found that different gender uses different coping mechanism when facing stressors. As further highlighted by Aldwin et al. (1996), older people, through their greater range of experience, could have developed more coping resources and appraised situations as a challenge rather than a hindrance. Besides, older adults would have experienced more stressful events, such as the death of loved ones, making everyday work problems pale in comparison. Concomitantly, Nikolaev (2016) has shown that education was associated with more positive than negative emotions towards the situations they face at work.

As such, including gender, age group, and education level as the control variable would enable us to uncover their influence on the relationships under investigation.

Results

Measurement model

Table 2 shows the result of the measurement model assessment. As shown, the composite reliability and the Cronbach's Alpha of all constructs exceed the threshold of 0.70. At the same time, the average variance extracted (AVE) are greater than 0.50. Using the Heterotrait-monotrait ratio (HTMT) test, Table 3 shows that discriminant validity has been achieved as all the values are below the threshold requirement of 0.85.

Structural model

Before assessing the structural model, we tested the possibility of multicollinearity via the variance inflation factor (VIF). As seen in Table 4, the VIF value is less than 3.3, indicating that multicollinearity is not a concern in this model. The results presented in Table 4 also showed that

Table 2. Convergence validity.

		Outer loading	CA	CR	AVE
Need for autonomy	AUT1	0.726	0.765	0.849	0.584
	AUT2	*del*			
	AUT3	0.819			
	AUT4	*del*			
	AUT5	0.750			
	AUT6	0.760			
	AUT7	*del*			
Challenge appraisal of STARA	CA1	0.859	0.885	0.920	0.743
	CA2	0.889			
	CA3	0.871			
	CA4	0.828			
Need for competence	COMP1	*del*	0.769	0.868	0.689
	COMP2	0.714			
	COMP3	0.867			
	COMP4	0.898			
	COMP5	*del*			
	COMP6	*del*			
Hindrance appraisal of STARA	HA1	0.841	0.903	0.932	0.774
	HA2	0.912			
	HA3	0.904			
	HA4	0.861			
Individual competitive productivity	ICP1	0.536	0.879	0.902	0.511
	ICP2	0.718			
	ICP3	0.631			
	ICP4	0.658			
	ICP5	0.758			
	ICP6	0.725			
	ICP7	0.832			
	ICP8	0.859			
	ICP9	0.662			
Need for relatedness	REL1	0.840	0.865	0.903	0.65
	REL2	0.777			
	REL3	*del*			
	REL4	0.760			
	REL5	0.814			
	REL6	*del*			
	REL7	*del*			
	REL8	0.836			

Note: CA = Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted; Del = deleted.

Table 3. Discriminant validity.

	1	2	3	4	5	6
AUT						
CA	0.588					
COMP	0.797	0.528				
HA	0.313	0.253	0.174			
ICP	0.397	0.357	0.449	0.151		
REL	0.663	0.506	0.646	0.209	0.370	

Note: AUT = Need for Autonomy; CA = Challenge appraisal; COMP = Need for Competence; HA = Hindrance appraisal, ICP = Individual Competitive Productivity; REL = Need for relatedness. Discriminant validity achieved at HTMT_{0.85}.

challenge appraisal of STARA awareness has a significant positive relationship with the need for autonomy (H1a: $\beta = 0.467$, $p < 0.001$), relatedness (H1b: $\beta = 0.424$, $p < 0.001$) and competence (H1c: $\beta = 0.424$, $p < 0.001$). On the effect of hindrance appraisal, results showed that it has a significant positive relationship with the need for autonomy (H2a: $\beta = 0.155$, $p < 0.05$) but not with the need for relatedness (H2b: $\beta = 0.096$, $p = 0.069$) and need for competence (H2c: $\beta = 0.047$, $p = 0.243$). Hence, H1a, 1b, 1c and 2a are supported. Of the three basic psychological needs, only the need for relatedness (H3b: $\beta = 0.143$, $p < 0.05$) and competence (H3c: $\beta = 0.235$, $p < 0.05$) established a significant positive relationship with ICP. On the other hand, results showed that the need for autonomy does not have any relationship with ICP (H3a: $\beta = 0.122$, $p = 0.071$). Hence, H3b and H3c are supported. The mediation results further showed that only the need for relatedness (H4b: $\beta = 0.061$, $p < 0.05$) and the need for competence (H4c: $\beta = 0.100$, $p < 0.05$) are mediators to the relationship between challenge appraisal of STARA awareness and ICP. The rest of the mediation hypotheses failed to establish any significant relationship. Hence, only H4b and H4c are supported. Finally, results also show that none of the control variables established any significant relationship with the endogenous variables.

As shown in Table 4, the R^2 value of the need for autonomy is 19.2%, indicating that both challenge and hindrance appraisal accounted for 19.2% of the variance in the need for autonomy. According to Cohen (1988), this can be considered a moderate model. Likewise, the R^2 value of the need for relatedness and need for competency is 20.8% and 18%, respectively, which signify a moderate model too. Regarding effect sizes, it can be observed that hindrance appraisal of STARA awareness has a negligible effect in producing the R^2 for the need for autonomy ($f^2 = 0.031$), relatedness ($f^2 = 0.011$) and competence ($f^2 = 0.031$). At the same time, the three basic psychological needs also have small effects on producing the R^2 value of ICP. Finally, challenge appraisal of STARA awareness has medium to large effects in producing the R^2 of the need for autonomy ($f^2 = 0.285$), relatedness ($f^2 = 0.214$) and competence ($f^2 = 0.211$).

Predictive power

In quantitative research, predictive analysis is an aspect of growing importance. Through predictive analytics, organizations can leverage statistical algorithms to identify the likelihood of future outcomes based on historical data (Tan et al., 2022d). Based on the PLS predict technique, Table 5 shows that the values for almost all of the PLS-SEM's root mean square error (RMSE) values and mean absolute error (MAE) are smaller than the linear model. Shmueli et al. (2019)'s guidelines gave us reasonable grounds to believe that our model displays high predictive power in forecasting the outcome of new cases.

Discussion

In developing our theoretical framework, we drew on the challenge-hindrance framework and SDT (Deci & Ryan, 2000) to postulate that satisfaction of our basic psychological needs is dependent on

Table 4. Structural model.

		Path coefficient	Standard Error	<i>t</i> -value	5%	95%	VIF	<i>f</i> ²	<i>R</i> ²
H1a	CA → AUT	0.467	0.056	8.357***	0.361	0.547	1.057	0.285	0.192
H1b	CA → REL	0.424	0.069	6.148***	0.296	0.525	1.057	0.214	0.208
H1c	CA → COMP	0.424	0.076	5.621***	0.284	0.536	1.057	0.211	0.180
H2a	HA → AUT	0.155	0.062	2.496**	0.045	0.249	1.057	0.031	
H2b	HA → REL	0.096	0.065	1.484 ^(NS)	-0.020	0.193	1.057	0.011	
H2c	HA → COMP	0.047	0.068	0.696 ^(NS)	-0.071	0.151	1.057	0.003	
H3a	AUT → ICP	0.122	0.084	1.466 ^(NS)	-0.023	0.254	1.758	0.010	0.276
3b	REL → ICP	0.143	0.074	1.924**	0.015	0.261	1.556	0.016	
H3c	COMP → ICP	0.235	0.080	2.928**	0.089	0.355	1.746	0.039	
H4a	CA → AUT → ICP	0.057	0.041	1.398 ^(NS)	-0.008	0.126			
H4b	CA → REL → ICP	0.061	0.035	1.723**	0.007	0.122			
H4c	CA → COMP → ICP	0.100	0.039	2.533**	0.039	0.166			
H5a	HA → AUT → ICP	0.019	0.017	1.148 ^(NS)	-0.001	0.053			
H5b	HA → REL → ICP	0.014	0.012	1.135 ^(NS)	-0.001	0.040			
H5c	HA → COMP → ICP	0.011	0.018	0.602 ^(NS)	-0.015	0.044			
	Control variables	Path coefficient	Standard Error	<i>t</i>-value					
	Highest_Edu × AUT → ICP	-0.002	0.105	0.015 ^(NS)					
	Highest_Edu × COMP → ICP	0.003	0.103	0.028 ^(NS)					
	Highest_Edu × REL → ICP	-0.042	0.102	0.410 ^(NS)					
	YOB × REL → ICP	0.074	0.086	0.859 ^(NS)					
	YOB × COMP → ICP	0.091	0.090	1.013 ^(NS)					
	YOB × AUT → ICP	-0.121	0.081	1.505 ^(NS)					
	Gender × REL → ICP	0.071	0.174	0.407 ^(NS)					
	Gender × COMP → ICP	0.089	0.164	0.543 ^(NS)					
	Gender × AUT → ICP	-0.088	0.171	0.514 ^(NS)					

Note: AUT = Need for Autonomy; CA = Challenge appraisal; COMP = Need for Competence; HA = Hindrance appraisal, ICP = Individual Competitive Productivity; REL = Need for relatedness; * $p < 0.1$; ** $p < 0.05$, *** $p < 0.001$, NS: not significant.

our appraisal of the job situation, specifically on STARA awareness, as either a challenge or a hindrance, which subsequently influences our performance at the workplace.

First, our results supported the premise that appraising STARA awareness as a challenge increases satisfaction with autonomy, relatedness, and competency, thereby supporting H1a, H1b, and H1c. This result is expected because having such a positive appraisal towards STARA helps employees fulfil their career goals by reaping the benefits of technology at the workplace (Ding & Hung, 2021). Interestingly, we discovered that a hindrance appraisal fulfilled the need for autonomy, which is in contrast to our hypothesis. This may be explained by Ding (2021)'s argument that due to the fear of job insecurity, hindrance appraisal may drive employees to passively cope with STARA by adapting to the technology-driven changing work environment through self-paced learning, thus instilling employees with a sense of autonomy.

Second, our study found that both needs for relatedness and competency were positively related to ICP, aligning well with the meta-analytic review by Van den Broeck et al. (2016), who showed that basic psychological needs are positively related to performance and organizational citizenship behaviours (OCB). However, we found that the need for autonomy was not related to ICP. The non-significant relationship between the need for autonomy and ICP could be explained by employee's low motivational drive. Dysvik, Kuvaas, and Gagné (2013) demonstrated that the relationship between perceived job autonomy and work performance was driven by intrinsic motivation. They argued that the relationship between job autonomy and work performance depends on whether the employees have a certain level of interest, pleasure, and enjoyment in their work. Without such intrinsic interest in their work, even a fulfilled need for autonomy is not sufficient to drive higher performance.

Third, given that there is a direct relationship between challenge appraisal towards STARA and ICP, we argued that the relationship between challenge appraisal towards STARA awareness and ICP is mediated by basic psychological needs (Ding, 2021). Our results supported the premise that the challenges introduced by STARA fulfilled the needs for relatedness and competency, which subsequently drive higher performance in employees (Gagne et al., 2022). In this regard, our findings have also extended Yang and Li (2021)'s study, which showed that challenge stressor is a positive psychological resource that produces thriving at work through positive affect and self-efficacy. Similarly, our findings showed that such resources could motivate higher productivity through fulfilled psychological needs for relatedness and competency. Given earlier findings that hindrance appraisal was not related to needs for relatedness and competency while the need for autonomy was not related to ICP, it is not surprising to see that basic psychological needs do not mediate the relationship between hindrance appraisal towards STARA awareness and ICP.

Overall, our study effectively addressed the research question concerning the psychological mechanisms bridging STARA and individual benefit. The findings demonstrate that perceiving STARA as a challenge positively influences satisfaction with autonomy, relatedness, and competency. Furthermore, the fulfilment of relatedness and competency needs has a positive influence ICP. The

Table 5. Predictive analysis.

	Q ² predict	PLS-SEM RMSE	PLS-SEM MAE	LM RMSE	LM MAE	PLS-LM RMSE	PLS-LM MAE
ICP1	0.030	1.444	1.127	1.486	1.165	-0.042	-0.038
ICP2	0.042	1.267	0.999	1.346	1.045	-0.079	-0.046
ICP3	0.044	1.305	1.033	1.356	1.040	-0.051	-0.007
ICP4	0.039	1.257	1.032	1.312	1.058	-0.055	-0.026
ICP5	0.055	1.145	0.943	1.140	0.912	0.005	0.031
ICP6	0.048	1.196	0.959	1.215	0.970	-0.019	-0.011
ICP7	0.027	1.133	0.947	1.171	0.977	-0.038	-0.030
ICP8	0.059	1.199	1.002	1.227	1.015	-0.028	-0.013
ICP9	0.038	1.182	0.942	1.234	0.974	-0.052	-0.032

Note: MAE = Mean absolute error; RMSE = root mean squared error; ICP = Individual Competitive Productivity.

study also reveals that the relationship between challenge appraisal of STARA and ICP is mediated by the satisfaction of relatedness and competency needs.

Theoretical implications

Our study offers several theoretical contributions. First, this study demonstrated that individual appraisal towards STARA awareness has differential outcomes towards the satisfaction of the basic psychological needs of autonomy, relatedness and competency, thereby integrating the lens of challenge-hindrances framework (Cavanaugh et al., 2000) and SDT (Gagne et al., 2022). Apart from that, this study has provided insights into how employees' basic psychological needs can be satisfied with the introduction of STARA into the workplace. Our study also demonstrates that different employees can appraise STARA awareness differently, which leads to different outcomes, specifically the basic psychological needs, thus supporting the challenge-hindrances framework and SDT in the context of the future of work involving STARA.

In that sense, our study extends extant empirical studies such as Van den Broeck et al. (2016), by demonstrating that fulfilling basic psychological needs at work is necessary to achieve positive organizational outcomes such as ICP. Additionally, we untangled the psychological mechanism underlying how a challenge appraisal towards STARA awareness is related to ICP by identifying the necessity to fulfil two essential needs (relatedness and competency). Our findings suggest that positive psychological resources in the form of challenge appraisals could motivate higher ICP among employees through the satisfaction of the need for relatedness and competency.

Finally, we responded to Van den Broeck et al.'s (2016) call by being the first few studies that used time-lagged data collection method. Besides, through PLS-SEM, this study performed predictive analytics, which extended the results of other studies, such as Ding (2021). According to Sarstedt and Danks (2021), researchers need to supplement the explanatory perspective with a predictive focus. This is particularly important to social sciences researchers, given the efficient nature of the research and the direct impact on managerial decision-making.

Managerial implications

This study also provides several managerial implications that can benefit practitioners in the hospitality industry to effectively navigate the challenges and leverage the potential benefits of STARA adoption. Within this sector, it is essential for managers to recognize and address the work stress experienced by employees due to the evolving work environment driven by technology. This is because employee's appraisal of STARA awareness could have a different impact on fulfilling their basic psychological needs, subsequently affecting their ICP in the workplace.

Firstly, it is crucial for managers to foster a culture that encourages employees to perceive STARA as a challenge rather than a hindrance. For instance, managers should prioritize the provision of sufficient learning and professional development programmes for employees. By equipping them with the necessary knowledge and confidence to embrace STARA, employees are more likely to perceive STARA as an opportunity for career growth and fulfilment, rather than a threat. This positive appraisal, in turn, promotes the satisfaction of employees' needs for autonomy, relatedness, and competency, leading to higher levels of ICP.

Secondly, managers should prioritize the creation of a supportive work environment that facilitates employees' needs for relatedness and competency. This can be achieved by fostering collaboration and providing opportunities for skill development and recognition. For instance, managers could offer support and resources to help employees cope with the introduction of STARA. This support can manifest in various ways, including emotional support, which plays a crucial role in cultivating employees' psychological readiness to embrace technological changes. Managers should encourage open communication and create platforms for knowledge sharing

and peer support. By nurturing these basic psychological needs, managers can foster a work environment that promotes higher level of ICP among employees.

Additionally, managers in the hospitality industry should actively recognize and reward employees' efforts and achievements related to STARA. By doing so, managers can enhance employee's sense of competency and relatedness, which are important factors for fostering a positive work environment. Managers should proactively identify deserving employees for promotion opportunities, particularly to the managerial level, in order to create a sense of upward mobility and career advancement. These opportunities will not only entice employees to embrace the available career prospects provided by the advent of STARA but also shape positive evaluations towards STARA and encourage employees to embrace STARA. By perceiving STARA as a challenge that helps fulfil their basic psychological needs, employees are more likely to experience higher levels of ICP. As such, these managerial actions can effectively contribute to the successful implementation and adoption of STARA, ultimately driving higher level of employee performance and organizational success.

Limitations and future directions

As with any study, there are limitations to which our readers should be aware. Our study focuses on employees in China's hospitality industry, which may limit the generalisability of the findings across other industries and geographies. Although our intention helps to control for the homogeneity of the samples, it begs the question of whether the findings are similar in other industries and regions. Therefore, future studies should extend the samples to other industries and regions to help compare the findings. It is also fruitful to conduct a multi-group analysis comparing the findings from different regions within Asian locations that have begun adopting STARA to prepare for the future of work, mainly due to the COVID-19 pandemic where strict lockdowns were implemented nationwide.

Second, this study adopted the basic psychological needs measures by Deci and Ryan (2000) due to its stronger criterion-related validity (Van den Broeck et al., 2016). However, Van den Broeck et al. (2016) have cautioned that despite being widely used, the basic psychological needs instrument incorporates the antecedents and consequences of the basic psychological needs within the items instead of directly assessing them. Following Van den Broeck et al. (2016) suggestion, future studies may compare the results using the scale developed by Van den Broeck et al. (2010b).

Third, the non-significant relationship between the need for autonomy and ICP suggests the need for a moderator. We suggest motivational subdimensions (intrinsic regulation, integrated regulation, identified regulation, introjected regulation, external regulation) as the potential moderators in moderating the relationship between the needs for autonomy and ICP.

Data availability statement

The data supporting this study's findings are available from the corresponding author upon reasonable request.

Disclosure statement

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Ethics

In compliance with the National Health and Medical Research Council (NHMRC) 'National Statement on Ethical Conduct in Human Research' (2007), this project has been allocated Ethics Approval Number H8925.

Informed consent

Informed consent was obtained from all participants included in the study.

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Appendix 1. Survey items.

Instrument name	Items
Challenge appraisal toward STARA awareness (4 items)	<ol style="list-style-type: none"> 1. The job uncertainty generated from STARA will help me to learn a lot. 2. The job uncertainty generated from STARA will make the experience educational. 3. The job uncertainty generated from STARA will show me I can do something new. 4. The job uncertainty generated from STARA will keep me focused on doing well.
Hindrance appraisal toward STARA awareness (4 items)	<ol style="list-style-type: none"> 1. The job uncertainty generated from STARA will hinder any achievements I might have. 2. The job uncertainty generated from STARA will restrict my capability. 3. The job uncertainty generated from STARA will limit how well I can do. 4. The job uncertainty generated from STARA will prevent me from mastering difficult aspects of the work.
Basic Psychological Need (21 items)	<p>Autonomy</p> <ol style="list-style-type: none"> 1. I feel like I can make a lot of inputs to deciding how my job gets done. 2. I feel pressured at work (R). 3. I am free to express my ideas and opinions on the job. 4. When I am at work, I have to do what I am told (R). 5. My feelings are taken into consideration at work. 6. I feel like I can pretty much be myself at work. 7. There is not much opportunity for me to decide for myself how to go about my work (R). <p>Competence</p> <ol style="list-style-type: none"> 8. I do not feel very competent when I am at work (R). 9. People at work tell me I am good at what I do. 10. I have been able to learn interesting new skills on my job. <ol style="list-style-type: none"> 11. Most days I feel a sense of accomplishment from working. 12. On my job I do not get much of a chance to show how capable I am (R). 13. When I am working, I often do not feel very capable (R). <p>Relatedness</p> <ol style="list-style-type: none"> 14. I really like the people I work with. 15. I get along with people at work. 16. I pretty much keep to myself when I am at work (R). 17. I consider the people I work with to be my friends. 18. People at work care about me. 19. There are not many people at work that I am close to (R). 20. The people I work with do not seem to like me much (R). 21. People at work are pretty friendly towards me.
Individual competitive productivity (9 items)	<ol style="list-style-type: none"> 1. My work behavior is directed at beating the competition at my workplace. 2. I benchmark my work performance against my work team leaders in order to aspire to the same or higher job market position. 3. My work culture focuses on performance and competitiveness. 4. I am oriented toward positive customer service to retain restaurant customers for repeat business. 5. I develop myself through education and training. 6. I am knowledgeable and up-to-date with market developments. 7. I am all about creating an ideal work environment in this organization. 8. I am all about upgrading my work environment in this restaurant. 9. I work faster than other colleagues at my workplace.