Multidimensional latent traits of perceived organizational innovation: Differences between Thai and Egyptian employees

Nittaya Wongtada · Gillian Rice

Abstract A new approach, the multidimensional latent regression (MLR) approach of item response theory, is employed to evaluate the dimensions of individual employee creativity, workplace atmosphere, and workplace innovative activity. Based on the MLR concept, the relationships among the measurement scales of these variables are tested for their unidimensionality versus multidimensionality. Multidimensionality was found. While workplace atmosphere is closely linked to workplace innovative activity, individual employee creativity forms its own dimension but is still positively linked to the other two measures. To achieve an accurate comparison between the two groups of Thai and Egyptian employees who have the same levels of agreement with the scale items, it is necessary to adjust the scores of Egyptian employees downwards.

Keywords Item response theory · Multidimensional latent regression · Employee creativity · Organizational innovation · Thailand · Egypt

Today's economic environment is commonly referred to as an "innovation economy" because of the proportion of economic value attributable to the innovative capacity of the intangible capital in business. A firm's capacity to innovate is crucial to its long-term success. Although it might appear obvious that a certain type of organizational climate (one exemplifying open communication, healthy relationships, trust, the freedom to fail, a learning environment and so on) would encourage more creativity and innovation, it is not automatically the case in every cultural or institutional setting.

N. Wongtada
Graduate School of Business Administration, National Institute for Development Administration (NIDA), Bangkok 10240, Thailand
e-mail: nittaya@nida.nida.ac.th

G. Rice (✉)
School of Global Management & Leadership, Arizona State University, P.O. Box 37100, Phoenix, AZ 85069-7100, USA
e-mail: Gillian.Rice@asu.edu

A number of studies accentuate the need to conduct cross-cultural research studies in this field. For example, a study of leadership and innovation in 12 European countries implied that many important aspects of innovation processes, as well as the rate of innovation itself, may be influenced by the sociocultural context (Elenkov & Manev, 2005). Shin and Zhou (2003) found that transformational leadership had a stronger, positive relationship with creativity for Korean employees high on the cultural value of "conservation," than for those low on this value. "Conservation" is a value defined by Schwartz (1994) as the favoring of tradition, conformity, and security. The research showed that employees high on conservation were more willing to accept their managers' influence and exhibited more creativity in response to this influence. In a US study of creativity and values, however, creative performance was negatively correlated with the importance of tradition, conformity and security (Kasof, Chen, Himsel & Greenberger, 2007). Contrary to expectations, in Egypt, a controlling, hierarchical work environment was positively associated with employee creative behavior (Rice, 2006). In Egyptian organizations, a structured hierarchy with autonomous leadership is not necessarily incompatible with a caring atmosphere, work enjoyment, and a requirement for employees to provide initiative and ideas. Therefore, the theories about creativity and innovation and the managerial practices that encourage creativity and innovation, which have evolved in the context of Western cultural values and institutions may not apply readily in other settings.

Both countries studied here, Thailand and Egypt, face challenges with respect to becoming more innovative, and therefore, more economically developed and more competitive in the global marketplace. The challenges are inherent in their cultures and also in their institutional frameworks. Thai firms are moving much more slowly than Japanese, Korean and Taiwanese firms did in the transition from being imitators to innovators. Powerful members of the private sector organizations such as the Federation of Thai Industry tend to protect their short-term interests and lobby for export quotas and import levies, rather than promoting the innovation capabilities of Thai firms (Intarakumnerd, 2006). Also, as explained by Intarakumnerd (2006), Sino-Thais dominate the Thai business environment with family-ownership-control types of organizations. There are two possible effects. One is that innovation is impeded because of the culturally low acceptance of failure and a lack of merit-based management. The other possible effect is that the Chinese–Thai business culture is a positive phenomenon that seeks and tolerates risky ventures. In both Thailand and Egypt, Western innovative culture and technologies are slowly permeating the business culture. For example, in Egypt, this is most apparent in smaller firms that are run by Western-educated managers and in joint venture firms. The family-owned sector, in contrast, has been resistant to any infiltration of Western management practices. Rigidity and conservatism with a pronounced top-down hierarchy characterize the bureaucratic public sector firms. In general, Egyptians follow orders, are passive, and expect direction. Living in a society with unequal power distance means that Egyptians lack the skills to assume innovative responsibilities successfully. Most of them prefer the reassurance of proven ideas. They prefer not to explore risky options.

Our study has two related, specific objectives. One objective is to investigate the meaning of organizational innovation in Thailand and Egypt. The purpose is to be

able to contribute to the understanding of how to implement policies and practices to improve innovative performance in emerging economies. Based on a review of the literature, we postulate the construct of perceived organizational innovation is comprised of three sub-dimensions. These are individual employee creativity, workplace atmosphere, and workplace innovative activity. We report the results of studies conducted first in Egypt, and subsequently in Thailand, to assess these sub-dimensions and what might be the implications for further theoretical development and management practice.

Our second objective is methodological. We respond to the call of Shalley, Zhou and Oldham (2004) for additional research on the measurement of creativity. Although several field studies have found similar results concerning creativity in the workplace, different measures, such as subjective versus objective measures, might reveal different types or dimensions of creativity. Farmer, Tierney and Kung-McIntyre (2003) found that the highest creativity occurred when employees had a strong creative role identity and perceived that their organizations valued creative work. The concept of self-efficacy might be applicable to creativity (Shalley et al., 2004) and hence more work is needed to investigate employees' self-views of their creativity. In this study, therefore, we use a self-perception measure of employee creativity. Also from a methodological perspective, the transformation of employee creativity into workplace innovation needs further investigation. Rickards (2003) emphasizes the need for clarification of the relationship between creativity at the individual level and innovation at the organizational level. Based on the work of some researchers, he suggests that the concept of creativity might be assimilated by the innovation concept. In this study, we use a new method, the multidimensional latent regression (MLR) approach of item response theory, to evaluate our three postulated sub-dimensions of perceived organizational innovation: individual employee creativity, workplace atmosphere, and workplace innovative activity. Based on the MLR concept, the relationships among the measurement scales of these variables are tested for their unidimensionality versus multidimensionality. In the following, we review the related literature, explain our study methodology, present our results and discuss their implications for managerial practice, for theory-building researchers, and for researchers working with emerging economies.

Literature review

Creative performance refers to products, ideas and so on produced at the individual level, whereas innovation refers to successful implementation of these products at the organizational level (Oldham & Cummings, 1996).

Individual employee creativity Creativity is a function of an individual's domain-relevant skills (factual knowledge and technical skills in a particular knowledge domain) and creativity-related skills (cognitive style and work style; Amabile, 1996). Amabile and Gryskiewicz (1987) found that for R&D scientists, the most frequently mentioned feature of creative behavior was intrinsic motivation, defined as being self-driven, excited by the work itself, enthusiastic, attracted by the challenge of the

problem and not being motivated only by money, recognition or external directives. A Lithuanian study (Jaskyte & Kisieliene, 2006) supports the proposition that maintaining creativity in organizations depends on maintaining intrinsic motivation.

Individuals participate in the creative process in an interactive fashion by developing ideas and presenting them to relevant others; and then by learning from reactions, reworking ideas, and presenting them once again (Dewett, 2004). Amabile (1988, 1996) and Amabile, Conti, Coon, Lazenby and Herron (1996) demonstrate that whatever an individual's competencies in a knowledge domain and whatever creative-thinking skills an individual might possess, that person's social-environmental working conditions can significantly detract from or enhance the level of his/her creativity. The context in which an individual employee works influences his/her internal motivation, which then, subsequently, influences creative achievements. The literature (see, for example, Amabile, 1988, 1996; Farmer et al., 2003; Mumford, Scott, Gaddis & Strange, 2002; Von Krogh, Ichijo & Nonaka, 2000) suggests that creative behavior is influenced by contextual factors which we call "workplace atmosphere."

Workplace atmosphere This includes the following features of an organization's social-environmental context: care for employees, enjoyable ambiance, openness of communication, emotional and functional support provided by supervisors to their staff, employees' willingness to share expertise, ideas, and responsibilities in the creative process, and risk-orientation. Von Krogh et al. (2000) show that workplace atmospheres reflecting trust and a general impression of care facilitate employees' communication and knowledge-sharing, and improve their creative output. In a study of employees in a US oil field services company, George and Zhou (2007) found that when supervisors provided a supportive atmosphere for creativity, and positive mood was high, even negative mood had a strong positive relationship to creativity. Negative moods, explain George and Zhou, promote problem identification and dissatisfaction with the current situation that can encourage opportunity identification. Furthermore, this can push people to exert more effort to propose ideas and arrive at good quality solutions. Positive moods promote confidence and divergent thinking and thus both positive and negative moods contribute to creativity at work when there is a supportive supervisory context and a general feeling of positive energy in an organization.

Supervisory support discriminates between high and low creativity projects (Amabile et al., 1996). Support is especially salient in project goal clarity (Shalley, 1995) and in open interactions between an employee and supervisor (Tierney, Farmer & Graen, 1999). Supportive supervisors show concern for an employee's feelings and needs, encourage employees to voice their own concerns, provide positive, primarily informational feedback, and facilitate employee skill development (Deci & Ryan, 1987). Mumford and Gustafson (1988) found that supervisory encouragement to learn more in a particular knowledge domain influences the frequency of creative performance. What is important is that workers perceive encouragement (Amabile et al., 1996), because it is the psychological meaning of the social-environmental context to an individual that is important, and that can influence his/her creativity (Amabile, 1988). Employees' diary narratives suggest that subordinates' self-perceptions are enhanced when the leader consults with them about important decisions or issues (Amabile, Schatzel, Moneta & Kramer, 2004).

Transformational leadership (inspirational motivation, charisma, intellectual stimulation and individual consideration) is supportive of employee creativity (Shin & Zhou, 2003).

As well as supervisors, coworkers possess the potential to impact employee creativity (Woodman, Sawyer & Griffin, 1993). Coworkers can positively influence creativity via encouragement (Amabile et al., 1996). When Taiwanese employees perceived that coworkers expected them to be creative, their role identities as creative employees were stronger (Farmer et al., 2003). Madjar (2005) notes that before proposing an idea, employees need the reassurance from the relevant group of work-related others that it is acceptable and will not lead to exclusion from the group. She explains that immediate encouragement and assistance from this particular work group should have the strongest impact on creative performance. The reason might be because this group contains the people who will use and implement the creative idea.

Woodman et al. (1993) hypothesized that individual creative performance would be enhanced by a risk-taking context. This implies that an atmosphere reflecting a willingness to try new and different approaches could improve creativity. Using survey data collected from a large private US R&D organization, Dewett (2007) found that the effect of intrinsic motivation on creativity is transmitted through an increased willingness to take risks.

Workplace innovative activity Innovative activity can be assessed by the number of innovations, the speed of implementation of innovations and the newness of an innovation (see, for example, Deshpande, Farley & Webster, 1993) as well as by relative innovative activity in comparison to competitors. Although the terms, creativity and innovation, are often used interchangeably in the management literature, employee creativity is increasingly conceptualized as a necessary prerequisite and starting point for innovation. As such, innovation originates from within the individual, that is, from his/her new ideas (Scott & Bruce, 1994; Rickards, 2003; Shavinina & Seeratan, 2003; Zhou & George, 2001). Hence, we posit that individual employee creativity is positively associated with workplace innovative activity.

We also hypothesize that workplace atmosphere contributes to workplace innovative activity. This is based upon the numerous studies (for example, see Abbey & Dickson, 1983; Bates & Khasawneh, 2005; Montes, Moreno & Fernandez, 2004; Siegel & Kaemmerer, 1978) that provide evidence for a relationship between organizational atmosphere and innovation. Damanpour (1991), in a meta-analysis of organization innovation, found determinants of innovation are embedded in workplace atmosphere. One determinant was a lack of formalization with a low emphasis on strict rules. Another was a positive managerial attitude toward change. A manager who is favorable towards change creates a good climate for innovation. This is especially valuable in the implementation stage, where conflict resolution and coordination of efforts are important. In Swedish and US studies, Ekvall (1991) compared innovative and stagnant organizations and organizational departments. Those classified as innovative were rated higher on all the features of organizational atmosphere measured (challenge, freedom, idea-support, trust, dynamism, playfulness, debates, risk-taking, and idea-time). Wan, Ong and Lee (2005) support these findings. They show that in a sample of Singaporean firms, workplace atmosphere

factors such as willingness to take risk and willingness to exchange ideas are conducive to innovation. Organizational cultures that stress a carefully balanced combination of both autonomy and collaboration appear more likely to generate innovative products (Mumford, 2000). Senior managers indirectly influence such product innovations by encouraging intrapreneurial behavior. They directly influence organizational process innovation by taking a leadership approach, communicating a compelling vision, and setting up a structure and organizational culture that supports innovation (Elenkov & Manev, 2005). This might be affected by the sociocultural context. For example, Elenkov and Manev (2005) cite Tyler, Lind and Huo (1995) who showed that employees with low power distance values were more likely than employees in high power distance societies to have stronger personal rapport with their supervisors and to identify more closely with the supervisors' goals. This might suggest that employees in relatively lower power distance cultures would be more likely to be involved actively in innovation work promoted by their superiors.

Innovativeness requires an organizational culture in which variation is accepted: Sethi, Smith and Park (2001) found in a US survey of project managers from the marketing area that social cohesion has a negative effect on new product innovativeness. Therefore, the organizational culture hypothesized to enhance workplace innovativeness might be incompatible with the collectivist cultures of Egypt and Thailand. With respect to Asian cultures like Thailand, Bruton et al. (2007) ask how cultures that value harmony and trust can attain a proper balance of active and critical debate.

Based upon the above evidence from the literature review, we propose a model of the three sub-dimensions of organizational innovation: Individual employee creativity, workplace atmosphere, and workplace innovative activity, as diagrammed in Figure 1.

In summary, we hypothesize the following:

Hypothesis 1   There is a positive relationship between workplace atmosphere and individual employee creativity.
Hypothesis 2   There is a positive relationship between workplace atmosphere and workplace innovative activity.
Hypothesis 3   There is a positive relationship between individual employee creativity and workplace innovative activity.

Figure 1 The relationship between workplace atmosphere, individual employee creativity and workplace innovative activity
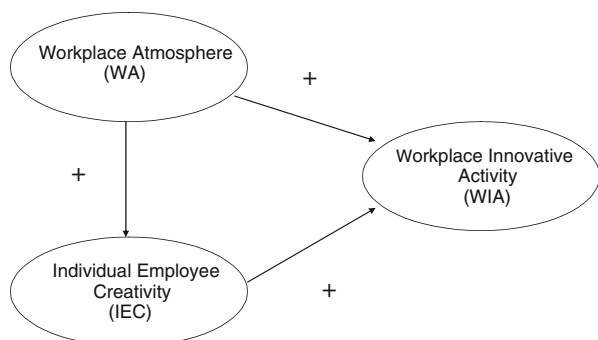
Data collection

We administered a self-completion questionnaire to employees at all staff and managerial levels in organizations in Cairo, Egypt (2004) and Bangkok, Thailand (2005 and 2006). We selected the organizations purposively to represent public and private sector firms and a variety of products and services. The industries included were the following: computer software (17% of the sample respondents), construction (22%), paint manufacturing (6%), processed food manufacturing (11%), cosmetics manufacturing (8%), educational administration services (11%) tourism/hotel services (10%), banking services (11%), and information technology/telecommunications services (13%).

In Cairo, the chief executive at each organization was asked to distribute the self-completion questionnaires such that a representation of employees from all departments would be obtained. A total of 240 questionnaires were dropped off and, after 10 days, 202 usable questionnaires were collected, giving a response rate of 84%. Examples of employee job functions included general manager, assistant manager, loan officer, software engineer, telecommunications engineer, sales manager, project manager, production manager, special events administrator, and financial manager.

A parallel "drop-off, pick-up" process of data collection was implemented in Bangkok in 2005. Thai managers from the same industries selected for the Egyptian sample and who were enrolled in Executive MBA programs at a university in Bangkok, were asked to distribute the questionnaire at their organizations with the objective of gaining representation from all departments and various job functions. From the responses, a quota of 202 questionnaires (matching the Egyptian sample size and characteristics as far as possible) was obtained.

Adequate sample size is a main concern in using item response theory (Downing, 2003; Watson, Baranowski, Thompson, Jago, Baranowski, & Klesges, 2006a). Large sample sizes artificially inflate the value of a statistic but with small sample sizes, there is a lack of statistical power. A sample size of 500 responses seems to be adequate for multidimensional data (Spencer, 2004). Hence, we decided to collect additional data from Thailand in 2006 replicating the industry types used in 2005 as closely as possible. Following customary practice, the sampling matching procedures were implemented in order to reduce possible biases from industry representation, as some industries might exemplify more innovative activities than others. For the 2006 data collection, we did not employ the "drop-off, pick-up" process. After the request for data collection, our staff handed out and collected back the questionnaire directly from each subject without further assistance from the company.

The total number in the sample is 606 respondents. Although the samples from the two countries are similar in several aspects, some differences occur. The sample from Thailand has more female, younger respondents than the Egyptian sample. Generally, the characteristics of the two Thai samples resemble one another. However, the 2006 sample represents more local companies and companies that have been operating for fewer years than the 2005 sample companies (Table 1).

Measures Creativity is a highly complex and diffuse construct (Mumford & Gustafson, 1988) and has proven difficult to measure. In previous research, the most

Table 1 Sample characteristics.

	Egypt (*n*=202) (collected in 2004)	Thailand (*n*=202) (collected in 2005)	Thailand (*n*=202) (collected in 2006)
Gender			
Male	157 (77.7%)	80 (36.6%)	82 (40.6%)
Female	45 (22.3%)	122 (60.4%)	120 (59.4%)
Age			
<25	93 (46%)	48 (23.8%)	50 (24.8%)
26–40	53 (26.2%)	142 (70.3%)	119 (58.9%)
>40	56 (27.7%)	12 (5.9%)	33 (16.3%)
Age of organization			
<10years	78 (39%)	40 (19.8%)	31 (15.3%)
10–30	79 (39%)	80 (36.6%)	114 (56.4%)
>30years	45 (22%)	82 (40.6%)	57 (28.2%)
Sector			
Public	46 (22.8%)	24 (11.9%)	37 (18.3%)
Private	156 (77.2%)	178 (88.1%)	165 (81.7%)
Primary ownership			
Local	82 (40.6%)	95 (47%)	131 (64.9%)
Foreign	120 (59.4%)	107 (53%)	71 (35.1%)

commonly used approach to studying creativity involves supervisory ratings of employees (Egan, 2005). Also, many studies use Amabile's (1996) consensual assessment technique where judges must reach an acceptable level of agreement as to the extent to which a product or process is creative. Others use measures such as the number of patents obtained (Zhou & Shalley, 2003). The impact of employees' self-perception regarding their individual creativity is emerging as an alternative approach (Egan, 2005). For example, in a Taiwanese study, Farmer et al. (2003) explored the concept of creative role identity, which they defined as whether individuals viewed themselves as creative. Their results suggested that three variables predicted creative role identity: creative expectations from coworkers, self-views of creative behavior, and exposure to US culture. Egan (2005), in an extensive review, concluded that, although creative idea generation does not appear to be common for most individuals in organizations, research using self-perception approaches shows that individuals with orientations toward creativity can be differentiated from those who are lower in the generation of creative ideas or outputs. Also, researchers have shown that there are characteristics that result in some individuals being more creative than others (Barron & Harrington, 1981; Gough, 1979); one of these characteristics is a firm sense of self as being creative. The self-perception approach to employee creativity is utilized in the present study. Therefore, rather than creativity being viewed only as an outcome, it is regarded as a process that is affected by perceptions of oneself (motivations, performance, and so on) and by perceptions of others' about oneself (such as perceptions of the boss or supervisor about one's creativity on the job). The latter set of perceptions could be connected with the "Pygmalion effect" studied by Tierney and Farmer (2004): This effect, similar to the "self-fulfilling prophecy phenomenon," states that positive external expectations about someone's performance produce higher performance. In particular, a key tenet of Tierney and Farmer's (2004) model is that supervisors are

more likely to engage in higher levels of behavior supportive of creativity with employees they anticipate or expect to be more creative in their work.

Here, individual employee creativity (IEC) is operationalized as an individual's perceptions of his/her creativity-related endeavors in the workplace, such as seeking new ideas, trying to be as creative as possible, learning new skills, and being intrinsically motivated to do creative work. The measure comprised ten five-point Likert scales (for details and literature sources, see Table 2). The dimensions, workplace atmosphere (WA), and workplace innovative activity (WIA) were also operationalized as an individual employee's perceptions of these characteristics of his/her organization, and were measured using the series of scales listed in Table 3. We used existing scales where possible. For each country, the questionnaire was translated from English into the Egyptian Arabic dialect or Thai, as appropriate, using a combination of back translation and parallel translation. Pre-testing ensured that any adjustments in translation did not affect the original meaning of the scales prior to the actual data collection.

Statistical techniques

In this study, we employ the multidimensional latent regression approach of item response theory (IRT) in assessing the dimensions relevant to perceived organizational innovativeness, in order to discover the relationships among individual employee creativity, workplace atmosphere, and workplace innovative activity.

Unidimensional latent traits and IRT IRT provides a set of statistical models that estimates the abilities, attitudes, interests, knowledge or proficiencies of respondents as well as specific psychometric characteristics of test items (Linardakis &

Table 2 Statements measuring perceptions of employee creativity.

Individual employee creativity (IEC)	Literature source(s)
I am more creative when working in a team	Adapted from Trompenaars and Hampden-Turner (1998)
My boss feels that I am creative in my job	Ganesan and Weitz (1996)
I experiment with new approaches to doing my job	Adapted from Ganesan and Weitz (1996)
I am on the lookout for new ideas from all the people with whom I interact as part of my job	Adapted from Ganesan and Weitz (1996)
I believe that I am currently very creative in my work	Amabile et al. (1996)
I try to be as creative as I can in my job	Ganesan and Weitz (1996)
I would like to learn some new skills that will help me to be more effective at work	Based on Mumford and Gustafson (1988)
When I perform well, I know it's because of my own desire to achieve	Oliver and Anderson (1994)
When new trends develop in my workplace, I am usually the first to get on board	Ganesan and Weitz (1996)
My work is so personally rewarding for me that I am indifferent to special incentives provided by management	

Each variable was measured on a Likert scale where "1" represented "strongly disagree" and "5" represented "strongly agree."

Table 3 Statements measuring perceptions of workplace atmosphere and workplace innovative activity.

	Literature source(s)
Workplace atmosphere(WA)	
It's very important to follow rules and procedures in my organization	Fyvie and Ager (1999)
My supervisor always provides me with clear instructions when assigning me a new project	Bakhtari (1995)
At my place of work, power is in the hands of relatively few people	Fyvie and Ager (1999)
Success in my organization requires initiative and providing ideas, more than commitment to rules and procedures	Al Sayed (2003)
My work environment is structured with all activities and projects carefully planned	
Procedures and structures are too formal in my organization	Amabile et al. (1996)
My supervisor always encourages me to learn new things	
My supervisor frequently consults me to ask for my opinion before making decisions	
In my workgroup, people usually only share information with other team members if they see that doing so will lead to some personal benefit	Von Krogh et al. (2000) Triandis (1995)
In my organization, people don't usually share information with people in other workgroups unless they see an advantage for their own work group	Van Krogh et al. (2000) Triandis (1995)
At work, I feel that I have a responsibility to share my expertise with others	Von Krogh et al. (2000) Triandis (1995), Forrester (2000) Von Krogh (1998)
In my organization, managers believe that time spent to reach collective decisions is valuable time	Al Sayed (2003)
Top management does not want to take risks in my organization	Amabile et al. (1996)
There is much emphasis in my organization on doing things the way we have always done them	Amabile et al. (1996)
People are encouraged to take risks in my organization	Amabile et al. (1996)
I enjoy doing my work so much that I forget other things	Amabile et al., (1994)
I feel a sense of time pressure in my work	Amabile et al. (1996) Mahmoud and Rice (1998)
There is truly an atmosphere of fun and playfulness at my workplace	Amabile et al. (1996)
There is free and open communication in my organization	
People are quite concerned about negative criticism of their work in my organization	Amabile et al. (1996)
In my organization, there is an atmosphere of caring about building up employees' skills and expertise	Von Krogh et al. (2000)
The members of my workgroup feel a strong sense of commitment to working for our organization	Amabile et al. (1996)
Workplace innovative activity (WIA)	
New ideas are always being tried out in my organization	Kitchell (1995) Kickul and Gundry (2001)
In my organization, lots of ideas are generated	Adapted from Amabile et al. (1996)
New workplace processes are often implemented in my organization	Amabile et al. (1996)
Compared to other organizations in Egypt/Thailand, my organization is one of the most innovative	

Table 3 (continued)

	Literature source(s)
My organization can respond quickly to changes in the external environment	
My organization regularly introduces new products/ services into the marketplace	Amabile et al. (1996)

Each variable was measured on a Likert scale where "1" represented "strongly disagree" and "5" represented "strongly agree."

Deliaportas, 2002). By placing the ability of the respondent and the difficulty of the item on the same measurement scale, the respondent's ability and the item can be compared directly (Spencer, 2004). According to Wilson, Allen, and Li (2006a), when IRT is applied to empirical attitudinal research, a participant responds to items on a questionnaire based on his/her underlying attitude and on his/her level of difficulty to endorse the item (that is, endorsability). If a respondent's attitude is strong and if the item is easily agreed with, that person has a very high probability of endorsing the item. Thus, IRT analysis of survey responses can provide estimates of the location of a person and of an item for the construct of interest, along with the standard errors of the estimates for person and item parameters and the whole test scale.

IRT differs from classical test theory (CTT) in many critical ways (Downing, 2003; Wilson et al., 2006b). CTT models focus on the total score of an instrument or test while IRT models provide the information at the item test levels, at the total test and at the respondent level. For CTT, the observed score (X) is a combination of the true score (T) and error (E). The T is the true assessment of the characteristic of interest on a particular instrument. The X and T represent the interaction between the instrument and the respondents' characteristics but the amount of the interaction is not shown directly. IRT, on the other hand, provides information regarding the instrument and the individual characteristics separately in terms of statistical estimation of parameters showing the locations of persons and items along a continuum or latent trait. It gives information on item difficulty and item discrimination ability for each item. Item difficulty is defined as how difficult it is for a person to respond positively to an item. Item discrimination refers to how well an item can discriminate between persons who have relatively higher or lower levels of a trait of interest. After estimates of relevant parameters are obtained, the appropriateness of the model and parameter estimates in explaining the patterns within the response data are evaluated (Wilson et al., 2006b; Watson, Baranowski & Thompson, 2006b).

The Rasch one parameter model, a special case of IRT, assumes that all items are assumed to have equal discriminating power; they vary only by item difficulty, and the probability of a correct guess is zero. In other words, all items can discriminate equally well between persons who have relatively higher or lower levels of a trait. Subjects with low ability have a high probability to miss the item and those with high ability have a low chance to answer the item correctly.

The partial credit model and rating scale model are extensions of the Rasch model that consider the ordinal nature of the responses (Wu, Adams & Wilson, 1998;

Wilson et al., 2006a). Here, in addition to the overall difficulty of the item, there is difficulty associated with each subsequent response option. This is based on the property of the ordinal response where the difficulty associated with making the next 'steps' among the response categories such as going from 'strongly disagree' to 'disagree' or from 'neither agree nor disagree' to 'agree' is observed. The partial credit model allows each item to have a different pattern of relative difficulty in endorsability or agreement when making the transition from one category to the next. That is, the partial credit model allows the steps to vary among the items. For instance, for the partial credit model, moving from the 'strongly disagree' category to 'disagree' may be easier than moving from the 'disagree' to 'neutral' categories. On the other hand, the rating scale model allows each item to differ only in its overall endorsability, but constrains the relative agreement of the steps to be the same across all the items. Put differently, the difficulty or ease is the same when a respondent moves from one category to the next.

Multidimensional item response theory (MIRT) The MIRT extends the traditional IRT to analyze more than one dimension. This is done by building on an assumption that there is a main construct which is composed of various dimensions measured by "subscales" (Allen & Wilson, 2006; te Marvelde, Glas, Van Landeghem & Van Damme, 2006; Watson et al., 2006a). Thus, the terms, subscales and dimensions, are used interchangeably here. MIRT examines whether subscales of interest belong to different constructs or whether they come from a single construct. Although a primary assumption for most IRT models is that the underlying trait is unidimensional, multidimensionality has been incorporated into an IRT model because the unidimensionality assumption may not be valid in many situations. For example, te Marvelde et al. (2006) conducted longitudinal educational surveys where students were repeatedly measured. Hence the responses at different time points are not independent. The multidimensional IRT (MIRT) model provides direct estimates of the relations between the latent variables at several time points, and so the accuracy of the parameter estimates is improved by allowing the relationship between the latent variables. Allen and Wilson (2006) used MIRT to investigate whether self-regulation can be regarded as a single construct, or whether it contains multiple dimensions (subscales) composed of the type of regulation or motivation that helps participants wanting to improve their healthy behavior.

There are two subtypes in the MIRT; between-items models and within-items models (Allen & Wilson, 2006). When each item is intended to measure only one dimension, the model is defined as multidimensional between-items. When the item is intended to measure two or more dimensions, the model is classified as multidimensional within-items. A between-item multidimensional model was used in this study, indicating that each item measured only one dimension. Thus, any possible interrelationship between items in the individual employee creativity (IEC), workplace atmosphere (WA) and workplace innovative activity (WIA) measurement subscales would be ignored if each subscale was treated independently.

The relationship between an item and the participant's response to a level of attitude on dimension d is described in Eq. 1 (Allen & Wilson, 2006). The probability that a person's response in category k (for example, the "agree" option)

of item i (P_{ik}) rather than category $k-1$ (for example, the, "disagree" option; P_{ik-1}) is related to the level of the person's attitude on that dimension (θ_d) and the relative difficulty for the person to endorse the level of agreement represented by the category k (δ_{ik}):

$$\log\,(P_{ik}/P_{ik-1}) = \theta_d - \delta_{ik} \tag{1}$$

Each individual processes several θ_d values, one for each dimension of attitude measured by the scale: $u=(\theta_1,\ldots,\theta_d)$, where these dimensions (or subscales: IEC, WA, WIA) are correlated. Thus, we can determine whether respondents use the response categories consistently across all items within a dimension (as in a 'rating scale model') or differently across different items (as in a 'partial credit model'; Allen & Wilson, 2006). When a relationship between subscales is present, more efficient estimation [smaller standard errors (SEs)] is achieved. Therefore, the multidimensional approach has the advantage of providing a measure for each trait being assessed, while simultaneously considering any correlation between the latent constructs.

Multidimensional latent regression (MLR) The MLR is an innovative method that employs the same concept of MIRT but develops even further the study of group differences in each of these scales or dimensions (Adams, Wu & Wang, 1997; te Marvelde et al., 2006, Watson et al., 2006a). The population is separated into several subgroups; the score distribution forms a parametric multinomial distribution with different latent densities (trait distribution) in each subgroup (Andersen, 2004). For our case, MIRT was employed to investigate perceived organizational innovation as the main construct which is composed of three dimensions or subscales: individual employee creativity, a supporting workplace atmosphere, and workplace innovative activity such as new product development. MIRT capitalizes on the correlations among these subscales. If these scales are highly correlated (that is, 0.95 or higher), they originate from the same trait. In other words, individual employee creativity, a supporting workplace atmosphere, and workplace innovative activity should not be considered as different constructs. If they indeed constitute unique constructs, their relationships can be gauged. Moreover, by using MLR, we can investigate further whether respondents from different countries (subgroups) differ on each parameter of IRT. In our case, we test how Egyptian and Thai employees differ in their responses to the individual employee creativity, workplace atmosphere, and workplace innovative activity scales.

Results

Assessment of unidimensionality Unidimensionality is a key assumption for most IRT models (Watson et al., 2006a, b). Unidimensionality was first tested by employing principal axis factoring to assess the existence of a major factor by observing the percentage of variance explained. Next, item and test characteristics including item means (item difficulty) and discrimination [the corrected item-total correlation (CITC)] were evaluated. Finally, the internal consistency reliability of the test was calculated using Cronbach's alpha. An adequately discriminating item is

identified if its CITC is more than 0.30 and adequate reliability is demonstrated with a reliability index of at least 0.70 (Watson et al., 2006b).

Individual employee creativity (IEC) The scree plot criterion with principal axis factoring confirmed the IEC Scale had one dominant factor. The percentage of variance explained was 31.7% and 10.5% for the first and second factors. For IRT, the presence of a major factor does not necessarily prohibit the presence of minor factors (Watson et al., 2006a). CTT (classical test theory) item analysis for the ten items of the IEC scale yielded difficulty estimates (item means) between 3.15 (SD= 0.92) and 4.32 (SD=0.80) based on the scale of 1–5. These values were clearly above the midpoint (midpoint=3), that is, the respondents had a tendency to agree with the items. The CITCs were acceptable to high (0.36 to 0.50), except for IEC9 (0.27). Therefore, IEC9 was deleted from the further analysis. Finally, the internal consistency of the nine-item scale, based on Cronbach's alpha, was 0.75.

Workplace atmosphere (WA) Based on principal axis factoring, the WA scale contained one dominant factor with 24.7% of variance explained. The item mean scores for the 22-item scale ranged from 2.83 (SD=2.17) to 3.87 (SD=0.87), indicating the tendency for the subjects to agree with these statements or to be at least neutral to them. The CITC analysis revealed several items have lower correlations than recommended (that is, 0.30). Items with less than this critical level were deleted. The final scale contained 12 items with the CITC in the range of 0.32 to 0.67. Principal axis factoring was reapplied to this set of items. The first component accounted for 40.33% of variance explained while the second component was only 8.27%. Cronbach's alpha was 0.86.

Workplace innovative activity (WIA) This six-item scale contained one prominent factor with 58.90% of variance explained. The item means varied within a smaller range compared to other scales in this study, that is, the highest mean was 3.28 (SD= 1.20) and the lowest mean was 3.04 (SD=1.17). The CITCs were high, in the range of 0.56 to 0.71. Finally, Cronbach's alpha was 0.86.

Assessment of item fit We employed ConQuest software (Adams & Wu, 2007) for all IRT analyses. The extent to which the Rasch model assumptions are violated was tested through "fit statistics" (Adams & Wu, 2007): infit and outfit (a weighted versus unweighted mean squared residual). Infit mean squares are influenced by unexpected patterns among more average observations while outfit mean squares are influenced by outliers. However, the accuracy of mean score values is sensitive to small sample size. The fit *t*-statistic is a better fit index because it takes sample size into account. The fit *t*-statistic is a transformation of the mean square into a standard normal distribution. Typically, a *t* value outside the range of −2.0 (underfit) to +2.0 (overfit) can be considered as an indication of misfit, at the 95% confidence level (Adams & Wu, 2007). Underfit is of particular interest since it indicates a higher level of randomness in the response data than that predicted by the model. Overfit implies too little variation in the response pattern that might be caused by the existence of redundant items (Casillas, Schulz, Robbins, Santos & Lee, 2006). Thus, it is not a major concern.
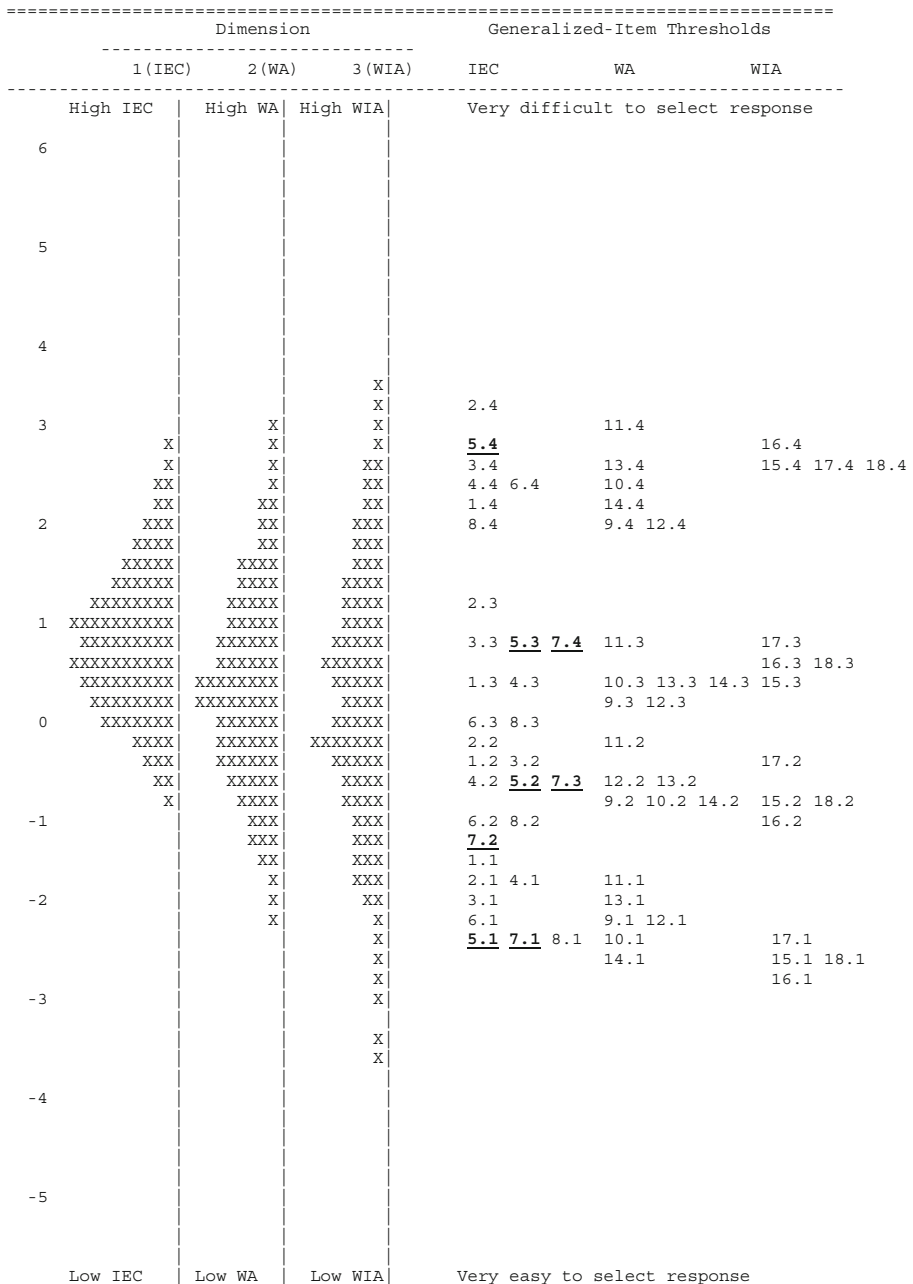
Upon examination of the IEC, WA, and WIA subscales using the IRT analysis, any items that had t values more than −2.0 (underfit) were excluded from the model. The final results containing the items shown in Table 4 indicate that the IEC, WA, and WIA models fit the data reasonably well.

Assessment of item and person parameters The Multidimensional Latent Regression provides much useful information in assessing the quality of items and the ability of participants. Item difficulty is spread out for the 18 items, with a difficulty range from 0.65 logits (a harder item) for IEC2 to −0.83 logits (an easier item) for IEC7 (see Table 4). Most of the items are easily endorsed by participants. The item discrimination for the IEC scale is in the range of 0.33 to 0.62 which is lower than that for the other two scales. This indicates that the IEC items cannot discriminate between participants with different levels of endorsability as well as the WA and WIA items can.

The latent distributions for IEC, WA and WIA, in conjunction with item thresholds, are also shown in the Wright Map in Figure 2. The logit scale is indicated in the outermost left hand column. The next section contains the person ability estimates that are linked to the column on the right which contains the item difficulty estimates. The logit scale is an interval scale of scores for both the difficulty of items and the ability of the persons tested. An item with a logit score of two is twice as difficult as an item with a logit score of one. Similarly, a person with a logit score of

Table 4 Description of items used in the MLR models, difficulty level, and discrimination index.

Item	Description	Difficulty	Discrimination
1	IEC1: I am more creative when working in a team	0.13	0.46
2	IEC2: My boss feels that I am creative in my job	0.65	0.62
3	IEC3: I experiment with new approaches to doing my job	0.29	0.54
4	IEC4: I am on the lookout for new ideas from all the people with whom I interact as part of my job	0.09	0.56
5	IEC5: I believe that I am currently very creative in my work	0.17	0.33
6	IEC6: I try to be as creative as I can in my job	−0.16	0.40
7	IEC7: I would like to learn some new skills that will help me to be more effective at work	−0.83	0.36
8	IEC8: When I perform well, I know it's because of my own desire to achieve	−0.34	0.41
9	WA21: My supervisor always encourages me to learn new things	−0.18	0.68
10	WA25: In my organization, managers believe that time spent to reach collective decisions is valuable time	−0.06	0.64
11	WA33: People are encouraged to take risks in my organization	0.43	0.68
12	WA44: There is free and open communication in my organization	−0.15	0.63
13	WA46: In my organization, there is an atmosphere of caring about building up employees' skills and expertise	0.11	0.69
14	WA47: The members of my workgroup feel a strong sense of commitment to working for our organization	−0.15	0.64
15	WIA1: New ideas are always being tried out in my organization.	−0.10	0.70
16	WIA2: In my organization, lots of ideas are generated	−0.09	0.73
17	WIA3: New workplace processes are often implemented in my organization	0.21	0.68
18	WIA4: Compared to other organizations in Egypt/Thailand, my organization is one of the most innovative	−0.02	0.76

```
================================================================================
               Dimension              Generalized-Item Thresholds
         ----------------------------  ------------------------------------------
         1(IEC)     2(WA)     3(WIA)    IEC          WA           WIA
--------------------------------------------------------------------------------
     High IEC  | High WA | High WIA|   Very difficult to select response
              |         |         |
   6          |         |         |
              |         |         |
              |         |         |
              |         |         |
              |         |         |
   5          |         |         |
              |         |         |
              |         |         |
              |         |         |
              |         |         |
   4          |         |         |
              |         |        X|
              |         |        X|   2.4
   3          |       X |        X|                11.4
            X |       X |        X|   5.4                        16.4
            X |       X |       XX|   3.4           13.4         15.4 17.4 18.4
           XX |       X |       XX|   4.4 6.4       10.4
           XX |      XX |       XX|   1.4           14.4
   2       XXX |      XX |      XXX|   8.4           9.4 12.4
          XXXX |      XX |      XXX|
         XXXXX |     XXXX|      XXX|
        XXXXXX |     XXXX|      XXXX|
       XXXXXXXX|     XXXXX|      XXXX|   2.3
   1 XXXXXXXXXX|     XXXXX|      XXXX|
       XXXXXXXXX|    XXXXXX|     XXXXX|   3.3 5.3 7.4 11.3        17.3
      XXXXXXXXXX|    XXXXXX|     XXXXXX|                         16.3 18.3
       XXXXXXXXX| XXXXXXXX|     XXXXX|   1.3 4.3     10.3 13.3 14.3 15.3
       XXXXXXXX| XXXXXXXX|      XXXX|                9.3 12.3
   0   XXXXXXX |    XXXXXX|     XXXXX|   6.3 8.3
          XXXX |    XXXXXX|   XXXXXXX|   2.2         11.2
           XXX |    XXXXXX|     XXXXX|   1.2 3.2                 17.2
            XX |     XXXXX|      XXXX|   4.2 5.2 7.3 12.2 13.2
             X |      XXXX|      XXXX|                9.2 10.2 14.2 15.2 18.2
  -1          |       XXX|       XXX|   6.2 8.2                  16.2
              |       XXX|       XXX|   7.2
              |        XX|       XXX|   1.1
              |         X|       XXX|   2.1 4.1     11.1
  -2          |         X|        XX|   3.1         13.1
              |         X|        X|   6.1         9.1 12.1
              |         |        X|   5.1 7.1 8.1 10.1          17.1
              |         |        X|                14.1         15.1 18.1
              |         |        X|                             16.1
  -3          |         |        X|
              |         |         |
              |         |        X|
              |         |        X|
              |         |         |
  -4          |         |         |
              |         |         |
              |         |         |
              |         |         |
  -5          |         |         |
              |         |         |
              |         |         |
      Low IEC  | Low WA | Low WIA|   Very easy to select response
================================================================================
Each 'X' represents   6.4 cases
The labels for thresholds show the levels of item, and step, respectively
```

Figure 2 Map of latent distributions and thresholds

two has twice the ability as a person with a logit score of one. Here, we can trace the relationship between item difficulty and a person's endorsability level.

Since we employed the partial credit model that allows the endorsability of each response category to be different, the information on thresholds is reported. Threshold 1 is the point at which the cumulative effect of the 'disagree', 'neutral', 'agree' and 'strongly agree' options is more likely than 'strongly disagree.' Threshold 2 represents the point at which the cumulative effect of the 'neutral', 'agree' and 'strongly agree' options is more likely than 'strongly disagree' and 'disagree.' Because there are five categories, four thresholds are reported. The results indicate that item thresholds varied. For example, IEC5 has wider thresholds than do those of IEC7. Their first thresholds (5.1 and 7.1) are at the same levels of ability/endorsability. However, it is more difficult for IEC5 to pass to threshold 2 (5.2) than it is for IEC7 (7.2). Similarly, threshold 4 for IEC5 (5.4) requires a higher level of ability/endorsability than IEC7 (7.4).

Generally, all of the items of all subscales are clustered around +3 and −3 logits, closer to an ideal situation in which the ability distribution should be normally distributed from −3 to +3 and item difficulty estimates would cover the total range of ability (Watson et al., 2006a). However, more items need to be added in order to cover the whole spectrum of the ability distribution.

The Wright map also provides information on the participant's ability estimates of IEC, WA, and WIA, along with the item difficulty estimates on the same logit scale. As shown on the left side of the figure, the ability distribution for IEC was skewed toward high ability (logits >1.0) while that of WA also covered the area of lower ability. For WIA, the participant ability estimates were spread out in both directions much more than for the other two dimensions.

The conditional reliability for the IEC, WA, and WIA scales derived from the multidimensional model is shown in Figure 3. Conditional reliability refers to the specified reliability at selected values of ability (Wilson et al., 2006a). Judging from the minimum acceptable ability at 0.70, lower reliability is seen at the upper end of the IEC continuum: The scale was less reliable for persons with high ability. For WA and WIA, the scales are reliable throughout the ability continuum. The conditional standard error of measurement, a mirror of reliability assessment, is shown on the left side of Figure 3. Similar to the conditional reliability, the relationship between the estimated location and the standard error of measurement is not a constant, but varies with the location of the respondent. The upper tail of IEC has higher SE while the tails of the WA and especially the WIA subscales rise to very high levels at both ends.

Research model assessment The covariance/correlation matrix shown in Table 5 indicates positive relationships among IEC, WA and WIA. This supports all three hypotheses and the research model proposed earlier. The correlations between WA and IEC and between IEC and WIA are relatively strong, that is, 0.600 and 0.619, respectively. The relationship between WA and WIA is closer to being unidimensional since their correlation approaches 0.900.

The regression coefficients represent the dimension estimates for Egypt to be equal to those of Thailand; for instance, for the IEC the coefficient is −0.326. This is based on the expectation that participants who are in different groups (Thais versus Egyptians) but have equal levels of ability would have the same probability of
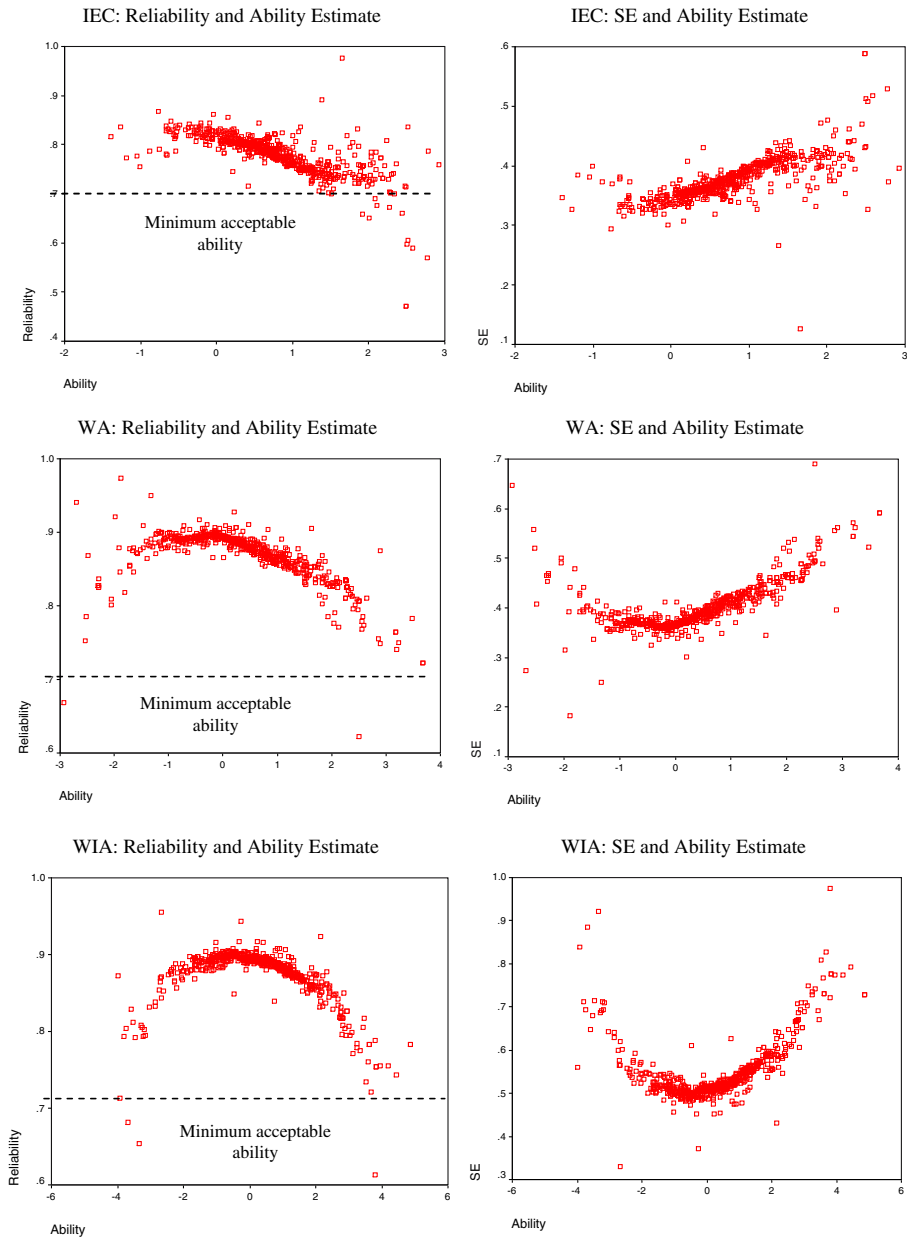
Figure 3 The reliability and standard errors (*SE*) plotted against the multidimensional trait estimates

selecting a particular response. By constraining the parameters to be zero, a negative coefficient suggests that +0.326 ability should be added to Thai participants in order to be able to compare the ability of Thai and Egyptian participants accurately. In other words, Egyptian participants had a higher tendency to express a stronger opinion on the IEC dimension than Thais, despite the fact they possessed the same level of latent

Table 5 Regression coefficients and covariance and correlation matrix.

	Dimensions		
	Regression coefficients		
Regression variable	Dimension 1(IEC)	Dimension 2(WA)	Dimension 3(WIA)
Constant	1.340 (0.121)	1.502 (0.168)	1.214 (0.234)
Country	−0.326 (0.070)	−0.681 (0.097)	−0.565 (0.135)
	Covariance/correlation matrix		
Dimension	1(IEC)	2(WA)	3(WIA)
Dimension 1 (IEC)		0.544	0.784
Dimension 2 (WA)	0.600		1.567
Dimension 3 (WIA)	0.619	0.891	
Variance	0.653	1.261	2.453

trait. Egyptian respondents displayed stronger opinions for all dimensions. The WA and WIA dimensions require higher adjustments than that for IEC.

Discussion

The use of the MLR approach enables us to make theoretical contributions to the literature. In particular, the MLR approach presents several benefits in model building including assessing scales, investigating the relationships among subscales of a construct, and observing differences in subgroups. For the scale assessment, the latent trait model gives two main useful pieces of information—a person's tendency to endorse the scale and the difficulty of endorsing an item. Although these scales (IEC, WA, and WIA) do reasonably well in capturing their relevant concepts, there is some room to strengthen them. The IEC items seem to represent those employees with higher levels of creativity than those with lower levels. The scale is reliable only at a narrow range, approximately a ±1 endorsability level. More items are needed at both ends of the ability level. In particular, those items with high difficulty to endorse and high discrimination are especially desirable. Currently, IEC2 (My boss feels that I am creative in my job) is most difficult to endorse and most discriminating. As with the IEC scale, the WA and WIA scales also require more items. Even though the WIA scale covers people with broader endorsability than the other two traits, it contains only four items that are too easy to endorse. In order to increase the performance of these scales, more information should be collected from those people with different levels of specific traits especially at the ends of the trait ability, and more items should be added to cover the whole range of the trait. Exploratory research should be conducted on items with lower discrimination to find out the reasons underlying this low ability to discriminate.

The MLR also allows us to investigate the relationship of the subscales of the construct, which is important from a theoretical perspective. Individual employee creativity, workplace atmosphere, and workplace innovative activity are dimensions of perceived organizational innovativeness. Although employee creativity is related to workplace atmosphere and workplace innovative activity, it is a unique dimension. Workplace atmosphere and workplace innovative activity are highly correlated to the point that they might belong to the same dimension. This implies

that a positive corporate atmosphere could intertwine with high innovative activity in the workplace. However, employee creativity is not translated immediately into workplace innovative activity. Similarly, a workplace atmosphere can encourage individual employee creativity but does not automatically translate into employees' positive creative behavior.

In addition, the MLR provides information on differences between subgroups. In general, the scores from Egyptian participants have to be adjusted downward since, as compared to Thai participants, they are much more likely to endorse the items to a greater degree even though both groups have the same level of a trait. In other words, for the same level of individual employee creativity, Egyptians tend to express stronger attitudes than Thais. Interestingly, the adjustment is higher for working environment and the company's success in innovation. Egyptians are less likely to express stronger opinions about themselves.

Limitations

The scales in this study can be improved by collecting information from employees with different levels of endorsability. In particular, a wider range of people with different degrees of creativity is needed. Similarly, although the items used in our scales were constructed mostly from the existing literature, they cannot cover a broad range of difficulty or endorsability. More items should be generated to capture every range of the trait of interest. By obtaining more information about a scale through improved measurement, such as identifying levels of the trait that are not as reliable, and levels of the trait which are not being reached, knowledge of the association between psychosocial measures and behaviors can be enhanced.

Except for the data collection in Thailand in 2006 (when the questionnaires were not distributed by managers), the surveys administered in Egypt and Thailand (in 2005) might contain social desirability bias from having the questionnaire distributed by people inside the company. Therefore, the responses may be inflated. The inflated amount can be checked easily with IRT for the Thai samples since we collected twice in that country. Unfortunately, this is not the case for Egypt because it is difficult to implement a better data collection procedure there.

Implications for researchers and managers

Our research study makes a number of contributions to the literature. The first contribution is theoretical. Workplace atmosphere and workplace innovative activity are closely intertwined but individual employee creativity relates to these two dimensions to a lesser degree. Rickards (2003) proposes, based on a research review, that the concept of creativity might be absorbed by the innovation concept. Our work implies that instead, work is needed regarding the conversion of creativity into innovation. In addition, further research is warranted on what needs to occur further with respect to the nurturing of employee creativity through the workplace atmosphere. The factors that underlie enhanced employee creativity might differ

from those that promote innovative activity in the workplace. For example, in a UK study of a hospital, Unsworth, Wall and Carter (2005) found, unexpectedly, that support for innovation did not significantly predict creativity. They explained their result by suggesting that organizational-level support might not manifest itself at the "local" departmental level.

Regarding measurement, most of the items tested for the IEC dimension were in the final model and include primary aspects of IEC such as intrinsic motivation, effort, learning new skills, supervisory perception and self-perception that have been put forth by other researchers. Although more items and more testing on different samples are needed, as discussed above, the scale items retained for the WA dimension are consistent with existing theoretical and empirical research: supervisory encouragement, shared decision-making, open communication, an atmosphere of caring, and a sense of commitment. Thus, the scale appears to have face validity, and convergent validity with extant measures is implied. The same can be said of the WIA scale where the four items represent the various stages of the innovation process: idea generation, testing, and implementation (see, for example, Scott & Bruce, 1994).

The second contribution of our study is methodological. We found the self-perception measure of creativity to be valid and reliable and we have clarified the relationship between the sub-dimensions of perceived organizational innovation. In particular, we tested relationships among the measurement scales of these variables for their unidimensionality versus multidimensionality and found multidimensionality. While workplace atmosphere is closely linked to workplace innovative activity, individual employee creativity forms its own dimension but is still positively linked to the other two measures. From the statistical perspective, when compared to CTT, IRT, especially MLR, provides more detailed information on the likelihood of a person with a particular level of ability to endorse a specific item. This is useful in developing a single scale as well as several scales simultaneously. Moreover, despite the fact that we employed the sampling matching procedure, our findings suggest implications for cross-cultural researchers: the results indicate that Egyptian respondents tend to inflate their responses more than Thais do. Techniques used to remedy this problem are, for example, to add more diverse subjects or to adjust the score. Additional responses can be added directly to the existing ones since this technique is sample free. However, MLR is still in the early stages of development for model construction. A test of the directional relationships between or among constructs is not currently available. More interest from model-building researchers should advance this technique substantially.

The third contribution of our study relates to managerial practice. It might appear obvious that a positive work atmosphere would lead to enhanced creativity, and subsequently to improved innovative activity. However, in practice, and especially in contexts where the culture might not encourage what is new and different, it is not so easy. Our results imply the following. The nurturing of a positive environment that already leads to workplace innovative activity might not necessarily be associated with individual employee creativity. Also, individual employee creativity might not result in organizational innovation. In order to encourage employees to participate in the creativity process, management needs to pay closer attention to different levels of employee creative behavior. Willingness to learn new skills is the easiest engagement

for employees, and so it does not differentiate those with a high from a low creative tendency. Despite this fact, it is the first step before engaging in other creative related behaviors. Looking out for new ideas and experimenting with new approaches are harder for employees to engage in, and therefore can discriminate better between those with different levels of creativity than can the willingness to learn new skills. Having the boss feel that they are creative is the most difficult thing to occur and can separate the highly creative employees from the ones less likely to behave creatively. This lends support to the finding of Amabile et al. (2004), that employees' self-perceptions with respect to creative work can be improved by supervisory behavior.

A supporting workplace atmosphere can stimulate employee creativity. Consistent with Dewett's (2007) results, it appears that both encouragement and self-efficacy can play important roles in understanding employee creativity, and then subsequently in appreciating the construct of organizational innovation. We found that employees easily sense management's encouragement to be creative, the free and open communication, and a strong sense of commitment to working for the organization. Collective decision making as well as an atmosphere of caring and support might be relatively simple to establish in organizations. However, encouraging someone to take risks, an important mediating variable for the effect of intrinsic motivation on creative performance (Dewett, 2007), is more challenging. We can view the prior activities as forming a foundation for employees to step out of their comfort zone to engage in something more risky.

Among practices relating to workplace innovative activity, the implementation of new workplace processes is harder. The organization can relatively easily generate new ideas and test them. To implement a new workplace process involves pervasive changes. Moving an organization towards being innovative by implementing new work processes may be too drastic and disrupt current practices which might lead to employees being unwilling to adopt the idea.

Even though the workplace atmosphere influences individual creativity and both of these factors in turn impact innovative activity in the workplace similarly for both countries, Egyptian employees tend to inflate their responses when compared to their Thai counterparts especially concerning their workplace achievements and environment.

Egyptian employees tend to express emotion and to use emphatic, elaborate verbal language marked by exaggeration for effect (Brown & Atalla, 2002). Nevertheless, Egyptians are less likely to express strong opinions when dealing with their own creativity. Thus, knowing these differences can facilitate an international company's cross-cultural management. When dealing with Thai employees, the management should not be alarmed if Thai employees are humble about everything (Niffenegger, Kulviwat & Engchanil, 2006).

In conclusion, our study demonstrates the value of using the Multidimensional Latent Regression approach for model development. Additional work, however, is needed in this direction as well as in investigating further the theoretical relationships between the dimensions of perceived organizational innovation, and in exploring how managers can enable workplace atmospheres that best enhance employee creativity and the implementation of innovations. The transition from creativity to innovation is especially important in the context of emerging economies whose institutions are often in a state of flux as governments implement more privatization. Emerging economy researchers need to account for cross-cultural differences when researching creativity

and innovation, for example, by using the MLR approach. There is also scope for further theoretical model development by incorporating the micro (individual-level, firm-level) and macro (institutional-level) factors in the overall process of how employee creativity evolves into organizational innovation.

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Nittaya Wongtada (PhD, University of Tennessee, Knoxville) is an assistant professor at National Institute of Development Administration, Bangkok, Thailand where she teaches marketing and international business. Her research interests are in the area of international business, competitiveness, innovation, branding, and item response theory. Her articles appear in journals such as *Journal of International Consumer Marketing*, *Journal of Business Research*, *Journal of Asia-Pacific Research*, and *Journal of Global Marketing*.

Gillian Rice (PhD, University of Bradford) is a lecturer at Arizona State University where she teaches marketing. She was a Fulbright Senior Scholar at the University of Bahrain in 1996–1997 and is Professor Emeritus at Thunderbird School of Global Management. Her research interests include environmentally related consumer behavior, the fair trade movement, and models of employee creativity and organizational innovation. She has published in journals such as *Journal of Business Research*, *Journal of Business Ethics*, *Journal of Global Marketing*, *Omega*, *International Journal of Forecasting*, and *Journal of International Consumer Marketing*. She is Book Review Editor and Columnist for *Global Business and Organizational Excellence*.