

THE CONTRIBUTION OF TEAMWORK, THINKING STYLES, AND INNOVATION TOWARDS KNOWLEDGE MANAGEMENT

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ABSTRACT

Knowledge management can be enhanced by creating conditions that facilitate knowledge creation, thus the concepts of teamwork, thinking styles, and innovation are central to the effective utilisation of knowledge. This paper presents the results of a survey of 156 civil servants at Putrajaya, investigating relationships between teamwork and thinking styles with technology diffusion and innovation and organisational innovation. The results indicated that team quality and external thinking style made the greatest contribution toward technology diffusion and innovation.

Keywords: Innovation, Teamwork, Thinking styles, Knowledge management

INTRODUCTION

The objective of this paper is to report the results of a study investigating the relationship between teamwork and thinking styles with technology diffusion and organisational innovation. These components are conceptualised as fundamental processes of knowledge generation. Knowledge management includes creating microenvironments conducive to generating knowledge in addition to harnessing both tacit and embedded knowledge (Gamble & Blackwell, 2002). This paper considers the contribution of two constructs; one at the group level (teamwork) and the other at the individual level (thinking style) to technological and organisational innovation which is one of the many processes underlying knowledge creation. The paper begins by defining teamwork and thinking style before relating them to innovation. It will then present the results of a survey using a sample of civil servants working at Putrajaya who responded to questions assessing the extent to which teamwork was practised, the nature of thinking styles employed, and the extent to which technological diffusion and organisational innovation occurred in their

workplace. The civil service is a driver for economic growth as well as human resource development. Thus it is crucial that civil servants work in conditions facilitating innovation and knowledge creation. The results have implications for knowledge management.

TEAMS AND INNOVATION

A basic definition of team is an interdependent group of employees sharing responsibility for group outcomes (Sundstrom, de Meuse, & Futrell, 1990). This emphasis on interdependence and shared responsibility differentiates teams from groups. Within this general definition, it is necessary to consider key elements of teams that contribute to team effectiveness. Past research had focused mainly on autonomy, flexibility, management support, effective communication and cooperation both within teams and with other teams or groups operating in the work environment.

Autonomy in the form of self-management and participation indicates that team members are given responsibility for coordination of work and resources, decision making, quality control, health and safety, and boundary management (Dunphy & Bryant, 1996). Members of autonomous work groups have reported an increase in intrinsic job satisfaction as well as the absence of negative mental health symptoms (Sonnentag, 1996). Interdependence impacts team effectiveness by developing a sense of shared responsibility and greater cooperation through increased cohesiveness and improved coordination and communication. Task and goal interdependence as well as interdependent feed-back and rewards have been shown to motivate team members (Campion, Medsker, & Higgs, 1993).

Multiskilling, flexibility, and heterogeneity of team members refers to the variety of skills and knowledge which enhances coordination and versatility and thereby team productivity and individual well-being (Sonnentag, 1996). Team process characteristics such as team interactions, social support, higher management support, communication, and cooperation have been found to be positively correlated with high job satisfaction and negatively correlated with burnout (Sonnentag, 1996; Campion et al., 1993).

Recent research had shown that teams may have both a negative and positive effect on innovation. Hoegl and Parboteeah (2007) have shown that team characteristics successfully acted as a moderator between domainrelevant skills and team efficiency while having a direct positive effect on team effectiveness. However the same concept indicated a significant negative moderator effect between creativity-relevant skills and team efficiency and effectiveness. The

authors suggested that innovative projects involve novelty and ambiguity, thus collaboration in teams drawing on the diverse knowledge and skills of team members would be effective in generating innovative products and solutions. However, this same tendency toward convergent thinking would act as an obstacle when team collaboration involves creativity-relevant skills. Support for the effectiveness of teams is presented by Carmen, de la Luz and Salustiano (2006), who found the two team characteristics of autonomy and informal communication to have direct positive relationships with innovation performance. Other team characteristics of skills diversity, knowledge, and social cohesion showed indirect but still significant relationships with product innovation. The importance of informal contact and communication was also supported by Kratzer, Leenders, and Van Engelen (2005) who found friendship as opposed to friendly relations to have a positive relationship with innovation performance.

In Malaysia the Knowledge-based Economy Masterplan launched in 2002 cites teamwork as one of the eight enabling skills crucial in human resource development for the K-economy and knowledge management. The review above supports this recommendation and also points to the need for more research on the specific relationship between teamwork and innovation performance.

Thinking Styles and Innovation

Thinking style represents relatively stable ways of processing information. They influence how information is perceived, processed, and guides individual behaviour. Sternberg (1997) presents a broad model of thinking styles based on the analogy of mental self-government. Four dimensions from this model have been used in this study. These are (1) functions of mental self-government consisting of the legislative, executive, and judicial thinking styles, (2) levels of mental self-government consisting of the local and global thinking styles, (3) scope of mental self-government consisting of the internal and external thinking styles, and (4) leanings of mental self-government where the individual shows a preference for either a liberal or conservative thinking style.

Each thinking style reflects an inclination for particular types of tasks or ways of working (Sternberg, 1997). The legislative style of thinking reflects a preference for tasks that challenge accepted views and favour creativity, the executive style is associated with an interest in implementation and the judicial style reflects the tendency to be evaluative. The local style indicates a preference for detailed work, whereas the global style indicates a preference for abstract ideas and broader perspectives. The internal style individual

enjoys working independently while the external style individual prefers tasks involving interaction with others. Finally the liberal style of thinking is best matched to tasks that are novel and/or ambiguous, while the conservative style indicates a tendency to adhere to existing rules and guidelines in performing tasks.

Past studies using Sternberg's measure of thinking styles have found significant relationships between the executive, conservative and internal thinking styles and higher academic achievement among Hong Kong, Philippine, and Spanish university students (Zhang, 2002; Bernado, Zhang, & Calleung, 2002; Cano-Garcia & Hughes, 2000). These studies have also reported negative relationships between the more complex legislative, liberal, and global thinking styles and academic achievement, suggesting that educational institutions appear to encourage conformity rather than creativity.

Zhang (2005) applied Sternberg's model to the workplace. In a study of 333 Chinese workers, it was reported that managers higher up in the organisational hierarchy reported greater use of the legislative, judicial, and hierarchical thinking styles. A preference for autonomy was associated with the judicial, global, liberal, and hierarchical thinking styles while the legislative, global, liberal, hierarchical, and executive thinking styles were strongly correlated with job satisfaction. In the context of innovation performance, Amadi-Echendu (2007) reported that thinking styles would be particularly important for innovation because of their relevance for the synergistic integration of experience, data, information, and knowledge toward innovative outcomes. The use of more sophisticated and complex thinking styles is important among knowledge workers so as to avoid cognitive overload that may result in costly mistakes for organisations. A sample of 330 senior research and development managers expressed a preference for left brain cerebral processing such as logical, problem solving, and analysing thinking styles as well as one right brain cerebral thinking style of conceptualising. Surprisingly these technical managers also highly rated the right brain limbic interpersonal thinking style indicating their recognition of the importance of personal networking skills for innovation performance. This brief review of past studies raises the need for more studies of thinking styles in relation to innovation as well as within the local cultural context.

Innovation and Knowledge Management

Innovation includes the creation, diffusion, transformation, and use of new ideas, practices, products, services, and technology to foster economic growth and development. Innovation can occur with respect to organisational practices

or technology, or it may involve both. A technological product innovation refers to the implementation of a new product with improved performance while a technological process innovation refers to improved production or delivery systems. Organisational innovation refers to management practices within an organisation and includes the implementation of techniques such as TQM or ISO 9000 programmes, significant changes in organisational structure, and the implementation of new corporate strategies (OCED, 1997).

Local studies have reported that better innovations occur within Japanese MNC operations as compared to local companies (Ong & Othman, 1999) A later study however found no significant differences between local and foreign companies although the study did not specifically focus on Japanese MNCs (Ismail, 2005). Nevertheless, it found that a creative climate environment, which is a precursor to innovation, was more evident in MNCs than in local companies. These studies raise the need for further local study of innovation, particularly with respect to factors facilitating innovation.

Based on the findings of both local and foreign studies, the objectives of this study were to determine the contribution of teamwork and thinking styles to technical and organisational innovation in Malaysia. It is hoped that the results would clarify the relative influence of group and individual factors in innovation.

METHOD

This was an exploratory study to determine the relationship between teamwork, thinking style, and innovation. A cross-sectional design was employed using a sample of civil servants obtained through convenience sampling.

Participants

The study sample consisted 156 of civil servants working at Putrajaya. The sample was predominantly female (59.4%), Malay (93.6%) and consisted mostly of first degree or diploma holders (62.6%). The sample was almost equally divided between senior management (42.3%) and middle management (40.4%) with the remainder of respondents consisting of support staff. Average age of the sample was 33.6 years and respondents had worked in the government service for an average of 6.3 years while occupying their current position for an average of 2.89 years. Thus the sample represents a relatively young group of government servants with all the necessary qualifications to be knowledge workers and very much involved in knowledge work.

Measures

All participants responded to five dimensions of the Team Characteristics Scale (Campion et al., 1993). For the sake of brevity, job design and interdependence were represented by three items per component. The remaining three components of team composition, context, and process were consolidated to form a construct labelled teamwork quality. The Campion scale had been previously used locally therefore the most valid items were selected to form a shortened scale consisting of 36 items. Respondents also completed the Thinking Styles Inventory (TSI) (Sternberg & Wagner, 1997). Each dimension was measured by three items. Again, as this scale had been used locally, thus the most valid items were selected to form a scale consisting of 27 items. Innovation was measured using a scale previously developed by Ismail (2005). The scale consisted of three sections. The first section measured technological transfer and diffusion of innovation, the second section measured organisational innovation focusing on basic elements of TQM and quality assurance activities, and the final section consisted of four items measuring innovation results.

All scales were presented in English only and respondents were instructed to indicate the extent to which each statement was true. A six point response continuum was provided ranging from *Not at all* to *Almost always*.

RESULTS

The following section presents the results of reliability and validity testing of the teamwork, TSI, and innovation scales before presenting both descriptive profiles and the results of inferential analysis.

Scale reliability

Alpha reliability coefficients for the three scales are presented in Table 1. Higher reliabilities were observed for the sub-scales of the teamwork and innovation scales whereas the thinking style reliabilities were considerably lower particularly for the global and liberal thinking styles. As the thinking style items had already been reduced to three items each, it was not possible to further eliminate items with low validity as this would have had a further negative effect on scale reliability. Therefore the thinking styles measure remained intact even though concerns have been raised about the continued usage of this shortened version.

Profile of Teamwork, Thinking Style and Innovation

Based on the item mean scores reported in Table 1, respondents have reported team quality as being most visible in their workplace. This was followed by job design elements and finally interdependence. The thinking styles profile shows preferred use of the judicial and executive thinking styles followed by the local, external, and liberal thinking styles. Finally a higher prevalence of technology diffusion and innovation has been reported in comparison to organisational innovation and innovation results. It must be noted that the mean scores shown are generally low for all three study variables. This suggests that teamwork, thinking style, and innovation are relevant but only at a moderate level and perhaps not as basic work processes.

Table 1. Means, standard deviations and reliabilities

Sub-scales	Item Mean	Standard Deviation	Alpha Reliability
Teamwork			
Job design	4.43	0.94	0.83
Interdependence	4.30	0.77	0.70
Team quality	4.77	0.81	0.91
Thinking Style			
Legislative	4.23	0.79	0.63
Executive	4.67	0.76	0.52
Judicial	4.74	0.68	0.74
Global	3.39	0.89	0.38
Local	4.54	0.80	0.61
Internal	3.81	1.13	0.69
External	4.74	0.73	0.61
Liberal	4.62	0.69	0.44
Conservative	4.07	0.95	0.65
Innovation			
Technological	4.59	0.80	0.89
Organisational	4.25	0.99	0.72
Innovation results	3.89	1.22	0.75
Total Innovation	4.33	0.88	0.87

The Relationship Between Teams, Thinking Style and Innovation

A correlation matrix of subscales for all three variables in this study showed strongest correlations occurring between team quality and the external thinking style (0.54) and the executive thinking style (0.45). Job design and interdependence showed a moderate relationship of 0.39 with the external thinking style. Lesser correlations were reported between the local thinking style and team quality (0.35) and with interdependence (0.37). All correlations were significant at the $p \leq 0.01$ level.

Of the three teamwork components, team quality showed the strongest correlation (0.51) with technological diffusion and innovation, followed by a correlation of 0.46 between job design and technology diffusion and innovation. Job design showed a lesser correlation of 0.26 with organisational innovation while interdependence showed a correlation of 0.29 with technology diffusion and innovation. All correlations were significant at the $p \leq 0.01$ level.

A similar pattern was observed in the correlations between thinking styles and innovation. The strongest correlations were observed between technology diffusion and innovation with the external (0.51), judicial (0.46), and local (0.41) thinking styles. Lesser correlations were observed between organisational innovation and the external (0.36), liberal and judicial (both 0.32) and local (0.27) thinking styles. All correlations were significant at the $p \leq 0.01$ level.

Innovation results showed the weakest correlations with the conservative (0.31), liberal and local (both 0.23) thinking styles. All correlations were significant at the $p \leq 0.01$ level.

The Contribution of Teamwork and Thinking Style towards Innovation

Of the three measures of innovation used, technology diffusion and innovation appeared to have had the most significance to the respondents in this study as shown by the high item mean as well as significant correlations. Therefore a linear regression analysis was carried out between all the independent variables, namely teamwork characteristics and thinking style with technology diffusion and innovation. The results indicated that the combined team and thinking style variables explained 48% of variance in technology diffusion and innovation ($R^2 = 0.48$; $F = 6.48$, $p \leq .001$). Examination of the β coefficients indicated that among the team characteristics, team quality showed the strongest coefficient ($\beta = 0.31$, $t = 2.98$, $p \leq 0.01$) followed by task variety ($\beta = 0.23$, $t = 2.48$, $p \leq 0.05$). From among the thinking styles, only the external thinking style made a significant contribution in explaining the variance in technology diffusion and innovation ($\beta = 0.24$, $t = 2.23$, $p \leq 0.05$). Interdependence as well as the other eight thinking styles did not significantly contribute to explaining variance in technology innovation.

DISCUSSION

The objective of this study was to determine the relationship between teamwork, thinking style, and innovation. The sample of civil servants reported moderate amounts of each of these three constructs present in their workplace.

Team quality was the most relevant aspect of teamwork and the thinking style profile highlighted the executive, judicial, local, external, and liberal thinking styles. Innovation was related mainly to technology diffusion. This profile can be explained by the nature of work among civil servants whose work involves planning, administration, and monitoring. Hence thinking styles related to implementation, attention to details, evaluation, and openness to new ideas were more relevant. Being a service organisation, there is also a considerable amount of interaction as reflected in the significance of the external thinking style and team quality. The priority given to technological diffusion and innovation indicates efforts to continuously improve the way in which work is performed.

The results of correlation and regression analysis indicated that team quality impacted most on work. From the job design variables, only task variety was significant while interdependence did not have much impact on innovation. This pattern of results suggested that aspects of team interaction and social support were most relevant for administrative work. The lesser emphasis on interdependence, self-management, participation, and task significance indicated that restructuring work toward greater autonomy and creating synergy among team members has not occurred. These civil servants appeared to be still working within a fairly rigid hierarchical organisational structure.

A similar pattern was observed for thinking styles where only the external thinking style showed statistical relevance to innovation. These results indicated that opportunities for working with others and exposure to a variety of tasks has significant impact on technology diffusion and innovation. The impact of this contribution however may be limited because other facilitators of innovation such as autonomy, involvement, critical evaluation, and broad perspective thinking were absent. It is possible that the pattern of results reflected a casual approach to teams as well as a greater focus on traditional administrative roles rather than path breaking innovation or creativity within the civil service. Considering that the sample is predominantly female and Malay, it is possible that these results are a reflection of the collectivistic qualities of ethnic Malay culture which have been infused with the bureaucratic organisational culture of the civil service.

This paper presents the results of an exploratory study conducted locally. Data exists from the manufacturing and educational sector, but not the public sector therefore the results of this exploratory study using a small sample should not be generalised. Another limitation of this study is the poor reliability scores of the TSI possibly because the shortened version was used. It is recommended that future users revert to the original length scale and further reliability testing is conducted to produce a more robust short version.

Even though exploratory, the results of this study do indicate some promising trends. Firstly, it is encouraging that some elements of teams and higher order thinking styles are present, suggesting that the foundation for developing knowledge workers and knowledge management is present. The salience of team quality and the external thinking style suggests that project groups, shared discussions, intranet, and other such channels for information exchange are critical elements of knowledge work within this type of work organisation. For a stronger push toward developing knowledge workers and effective knowledge management, efforts could be directed toward restructuring work conditions to encourage autonomy, task ownership, and more complex modes of information processing. Such developments could possibly encourage more innovative and creative work processes. Knowledge is the driver of the K-economy, thus reinforcing knowledge work and knowledge management through the effective use of group and individual level tools such as teamwork and thinking style would augur well for continued economic development.

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