Empirical Study on the Relationships between Climate for Innovation and Business Performance Outcomes in Design Firms

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Abstract:

Innovation has been widely regarded as a determinant of a firm's business performance. This paper reports on a study of "climate for innovation", which plays an important role in driving a firm's diffusion of innovation. Three major constructs underlying climate for innovation – organisational culture, leadership and team climate – are examined. A conceptual model was developed to study the relationships between such constructs and their effects on innovation diffusion outcomes, which can, in turn, influence business performance. Quantitatively, the model was assessed using Structural Equation Modelling (SEM) technique, based on the data collected from a survey of Australian Architecture and Engineering Design (AED) firms. The final model derived from the analysis indicates that leadership is a key predictor of innovation diffusion outcomes, functioning indirectly through team climate and organisational culture. More importantly, the outcomes of innovation diffusion were found to predict business performance, thus highlighting the benefits of design innovation in AED firms. Finally, the model was validated through explanatory case studies of two Australian design firms using pattern matching analysis.

Keywords:

Business performance, Climate for innovation, Design firms, Innovation diffusion

1. Introduction

Innovation has been widely acknowledged as an important ingredient for firm's competitiveness and economic growth. To successfully developing or implementing innovation, firms need to be able to understand how such innovation can be effectively diffused. Many scholars view innovation as a product of complex social interactions amongst members of a social system and have concluded that innovation and the process of diffusion are results of a social psychological process (Egbu et al., 1998; Rogers, 2003). Invariably, such a process manifests itself in the form of "climate" in an organisation, which is considered as a determinant of motivation and behaviour (Kozlowski and Doherty, 1989). Climate is defined as "a shared and enduring molar perception of the psychologically important aspects of the work environment" (Ashfort, 1985). To study climate in an organisation, Schneider and Reichers (1983) contend that researchers should focus on a specific facet of climate in order to deliver meaningful results. The study presented in this paper thus concentrates on the social psychological factors that constitute "climate for innovation". In addition, the study focuses on "design" as a context under which the climate for innovation was studied. According to Salter and Torbett (2003) design has long been recognised as an important part of the innovation process, yet it is poorly understood in innovation studies. Therefore, the study aims to address this gap by investigating the role of climate for innovation among AED firms.

The paper begins with the introduction of the development of a conceptual model, which depicts the relations among key constructs within the climate for innovation and their role on the diffusion of innovation and business performance. Each model construct and the rationale behind its development are delineated. A series of quantitative and qualitative analyses performed in relation to assessing the developed model are then presented. Finally, the paper ends with the discussion and conclusions of the research findings.

2. Conceptual Model Development

Extensive literature review regarding organisational creativity and innovation was conducted in order to explore factors that contribute to successful innovation and effective diffusion of innovation. As a result, three levels of social psychological factors forming a climate, which can be perceived by a member of an organisation, were identified; these are organisational level, supervisory level, and team level factors (Amabile *et al.*, 1996; West, 1997). The present study attempts to model the dynamics of these set of factors (constructs) by exploring the relationships between them, and their effects on the innovation-related outcomes. Fig. 1 illustrates the developed conceptual model and the hypothesised relationships between the constructs. The model proposes that there are three key climate constructs: (1) organisational culture for innovation; (2) leadership for innovation; and (3) team climate for innovation, each hypothesised to have a direct influence on outcomes of innovation diffusion. In addition, the model proposes that organisational culture and team climate for innovation are dependent upon the leadership for innovation. Finally, a direct relationship between innovation diffusion outcomes and business performance is proposed. The following sections elaborate on each model construct and rationale behind its development.

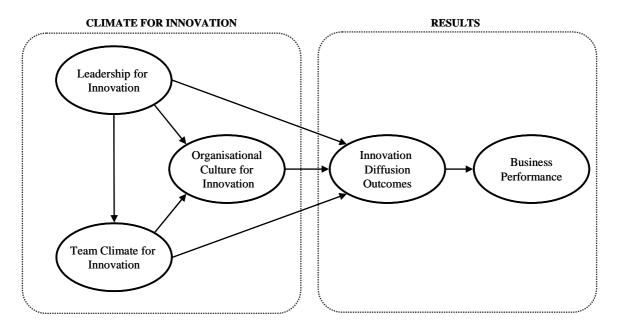


Fig. 1. Conceptual model

2.1. Leadership for Innovation

It has been widely accepted that leaders play a key role in determining innovation and creativity in an organisation (Montes *et al.*, 2005; Nam and Tatum, 1997). Innovation-conducive leaders always champion innovation by seeking out and promoting creative and innovative ideas (Howell and Higgins, 1990; Yukl *et al.*, 2002). They also stimulate creativity from team members by inspiring a future vision and encourage members to develop own ideas (Bass and Avolio, 1994). To achieve innovative outcomes, these leaders gain support from their subordinates by maintaining the quality of supportive relationships, encourage team members to share ideas and resources, and consult with team members when making decisions (Bass and Avolio, 1994; Yukl *et al.*, 2002). Past empirical studies have shown that innovative leadership significantly influences innovation directly and indirectly through such variables as organisational learning and team (e.g. Aragón-Correa *et al.*, 2007; Montes *et al.*, 2005). Accordingly, it is expected that leadership will influence organisational culture, team climate for innovation, and the level of innovation diffusion outcomes.

2.2. Team Climate for Innovation

It is critical to understand factors that hinder and foster creativity and innovation in teams since innovation has usually originated and subsequently been developed by teams into practice. West (1990) proposed the "four-factor theory" outlining factors characterising team climate for innovation: (1) *vision* refers to an establishment of clearly defined and shared goals that provides focus and direction to team members; (2) *participative safety* is a climate in which involvement in decision making is motivated and reinforced without fear of criticism; (3) *task orientation* refers to a shared concern with quality of task performance; and (4) *support for innovation* refers to the expectation, approval, and practical support of attempts to introduce new and improved ways of doing things. Empirically, innovative team climate was identified as a predictor of innovation outcomes by several authors. For example, Hurley (1995) studied employees' perception of work group culture (similar to team climate) and found a significant and positive influence of the innovative group's culture on innovative productivity. Reasonably, it can be presumed that a team climate for innovation can predict the level of innovation diffusion outcomes.

2.3. Organisational Culture for Innovation

Organisational culture is a primary determinant of innovation and has major facilitating and constraining effects on the successful implementation and maintenance of innovation (Ahmed, 1998; West, 1997). Therefore, the promotion of an innovation-supportive culture is most important in order to maintain a proactive and entrepreneurial organisation (Steele and Murray, 2004). In general, an innovative organisation provides a high level of freedom and autonomy, and exhibits a propensity for creativity by having a culture where there is a presence of flexibility and risk tolerance (Amabile *et al.*, 1996; Ekvall, 1996). Within such culture, innovation efforts are recognised and supported, and resources are usually set aside to facilitate such efforts (Amabile *et al.*, 1996). Several empirical studies have found a significant contribution of the perceptions of such cultural characteristics on innovation-related outcomes (e.g. Lau and Ngo, 2004). As such, it can be expected that organisational culture for innovation will influence the outcomes of innovation diffusion. As a final note, since leaders and members play a role in shaping an organisational culture (Ahmed, 1998), the paper proposes that organisational culture for innovation is influenced by leadership and team climate for innovation.

2.4. Innovation Diffusion Outcomes and Business Performance

According to Damanpour and Gopalakrishnan (1998), innovation can be appropriated by means of generation or adoption. In design sector, innovative design solution can be considered as a generated innovation which represents a bottom-up diffusion effort, whereas the successful adoption of advanced design technologies and/or practices mainly represents top-down attempts. Both were considered as indicators of innovation diffusion outcomes in the present study. Although there is currently no empirical study verifying the direct influence of design innovation on the business performance of AED firms, it is intuitively anticipated that such a link exists. To ascertain the benefits of design innovation, the relationship between innovation diffusion outcomes and business performance was proposed.

3. Research Design

In general, the measurement of climate is conducted primarily via quantitative-based questionnaire applied comparatively across several organisations (Patterson *et al.*, 2005). Therefore, a questionnaire survey research was deemed appropriate as an initial step to evaluate the ability of the conceptual model in representing prevalent phenomena among AED firms. In addition, according to Gable (1994), a survey research can be greatly improved when used in conjunction with other qualitative research methods, particularly a case study. Therefore, qualitative case study research was also adopted to further ascertain the validity of the model. As a result, the study was designed as a mixed method combining quantitative and qualitative analyses. The use of such a hybrid approach has been encouraged in construction management research (see Love *et al.*, 2002).

Overall, the research method was structured in two phases. The first phase involved a quantitative analysis using statistical technique to evaluate the conceptual model based on the data collected from a questionnaire survey of Australian AED firms. In particular, Structural Equation Modelling (SEM) technique using AMOS 7.0 was utilised to determine how well the developed model explain (fit) the data as well as to estimate parameters associated with the relationships between model constructs. The study employed the following model fit indices: normed chi-square (χ^2/df); goodness-of-fit index (GFI); comparative fit index (CFI); incremental fit index (IFI); and root mean square error of approximation (RMSEA). To be considered as having an adequate fit with the data, all the indices of the model should meet the following criteria: $\chi^2/df < 2.0$; GFI, CFI, and IFI > 0.90; and RMSEA < 0.08 (Hair *et al.*, 2006).

In the second phase, qualitative analysis using case studies was carried out to confirm the results obtained from the first phase. In general, case studies can be classified as descriptive, exploratory and explanatory: descriptive case studies focus on determining what needs to be described; exploratory case studies usually focus on theory and/or hypothesis development; and explanatory case studies focus on theory and/or hypothesis testing (Yin, 2003). For the purpose of this study, explanatory approach was adopted since the aim of conducting case studies was to validate the results from the quantitative analysis. In this case, the final model derived from the quantitative analysis represents a set of hypotheses to be tested. To qualitatively validate the model, the paper employed "pattern matching" technique in which patterns of the observed values of each construct identified from the case studies were compared with those predicted (hypothesised) by the model (Yin, 2003). In particular, the paper followed a pattern matching approach presented in Nicholson and Kiel (2007).

4. Analysis Results

4.1. Quantitative Analysis: Conceptual Model Assessment

The survey was conducted in Australia from May to August 2007. Sample firms were chosen first by randomly selecting a number of AED firms from the Dun and Bradstreet's *Australian Business Who is Who* database. An attempt was then made to obtain individual contact details of engineers, architects and para-professionals (e.g. draftsperson) working in the selected firms. In total, 520 survey packages containing a questionnaire, an introductory letter, an incentive and a pre-paid reply envelope were sent out via postal mail. Of the 520 surveys sent, 181 usable questionnaires were returned thus achieving a response rate of 34.8%. The majority of the respondents were engineers (44.8%) and architects (39.2%) aged between 26-30 (37%) and 31-40 (22.1%) with a bachelor's degree (77.3%). Most of them were employed in engineering consultancy firms (48.6%) and architecture firms (41.4%) with a size ranging from small-to-medium (\leq 200 employees, 57.8%) to large (> 200 employees, 42.2%). In addition, most of the respondents (64.2%) reported that design activity accounts for a large portion (61%-100%) of their firm's turnover. Overall, the respondents were considered a good representation of the survey population.

Based on the collected data, SEM was performed to preliminary evaluate the fit of the conceptual model as well as the hypothesised relationships between the constructs. Non-significant relationships were found and were then removed from the conceptual model resulting in a refined model. The fit indices of the conceptual model were then compared with those of the refined model in order to ensure that the final model best explains the data. Fig. 2 shows the results for the final model with standardised path coefficients. Overall, the fit indices of the model proved to be satisfactory: $\chi^2 = 158.20$; df = 85; $\chi^2/df = 1.86$; GFI = 0.89; CFI = 0.93; IFI = 0.93; and RMSEA = 0.07.

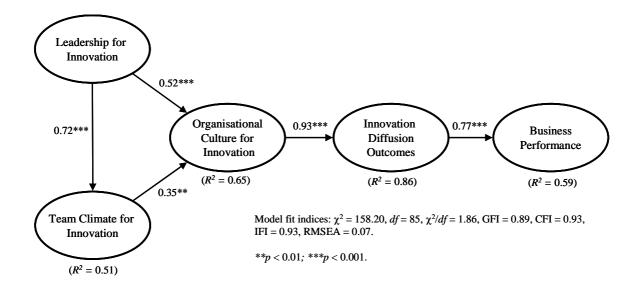


Fig. 2. Final model with standardised path coefficients

According to the path coefficients, leadership for innovation appears to have a strong and positive influence on team climate for innovation (0.72, p < 0.001), accounting for 51% of its variance ($R^2 = 0.51$). Both leadership (0.52, p < 0.001) and team climate for innovation (0.35, p < 0.01) are shown to have a positive influence on organisational culture for innovation, jointly explaining 65% of its variance ($R^2 = 0.65$). However, both constructs do not appear to directly influence the outcomes of innovation diffusion as hypothesised in the conceptual model presented in Fig. 1. Instead, they seem to influence this construct indirectly through organisational culture for innovation which has a very strong and positive direct effect on innovation diffusion outcomes (0.93, p < 0.001) and explains 86% of its variance ($R^2 = 0.86$). Finally, business performance appears to be strongly influenced by the outcomes of innovation diffusion (0.77, p < 0.001) with 59% of variance accounted for ($R^2 = 0.59$).

4.2. Qualitative Analysis: Model Validation

Following the results from the quantitative analysis, predicted patterns (see Fig. 3) were formulated based on the final model in Fig. 2 by taking into account standardised path coefficients. The standardised path coefficients in the final model were classified based on Cohen's (1988) effect size criteria as small (0.10 - 0.29), medium (0.30 - 0.49) and large (≥ 0.50) . Three main patterns were developed using high, medium and low values for the exogenous construct (i.e. leadership for innovation). Two additional patterns were also developed for predicted pattern 1 and 2 to accommodate the medium effect of team climate on organisational culture for innovation, which may lead to a slightly lower value of organisational culture for innovation in the circumstance where there is a presence of other unexplained factors.

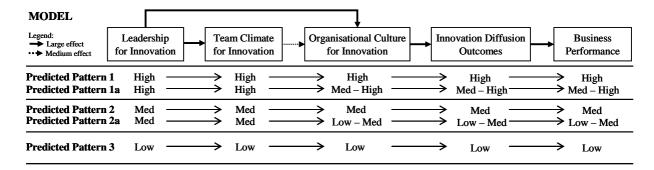


Fig. 3. Predicted patterns

Case studies were conducted with two Australian engineering design firms. The profiles of both cases are summarised in Table 1. Four members from the structural design team of each firm agreed to participate in the case studies. Semi-structured, face-to-face interviews were carried out to solicit opinions from the participants. An interview guide was developed and used during the interview session. Each interview was tape-recorded and transcribed. The contents of each interview were coded, summarised and tabulated to represent the value of each construct, which was rated against the developed criteria. In addition, secondary sources of information including newsletters and online documents published on a website were obtained from each firm and were analysed to complement the interview findings. Table 2 presents the final results of the case studies in terms of the patterns of the observed constructs and how they match the predicted patterns.

Table 1: Case study profiles

Case	No. of employees	Area of expertise	Scope	Interview participants
Firm A	360	Civil and structural engineering, infrastructure planning, value engineering	International	 1 senior structural engineer 2 junior structural engineers 1 structural drafting manager
Firm B	110	Civil and structural engineering, surveyors, geosciences	Regional	 1 engineering manager 1 experienced structural engineer 1 junior structural draftsperson 1 senior structural draftsperson

Table 2: Case study results

		Constructs					
Case	Leadership for Innovation	Team Climate for Innovation	Organisational Culture for Innovation	Innovation Diffusion Outcomes	Business Performance	Match	
Firm A	High	High	High	High	High	Match predicted pattern 1	
Firm B	Med to High	Med to High	Med	Low to Med	Med	Partial match predicted pattern 2a	

According to Table 2, the pattern of relationships between the observed constructs of Firm A matches the predicted pattern 1. The high level of leadership for innovation is associated with the high level of team climate for innovation. Both leadership and team climate for innovation are also associated with the high level of organisational culture for innovation. The junior engineers agreed that their supervisor influence a great deal on the climate for innovation in their team. They also pointed out that the main reason the firm possessing such a high degree of culture for innovation is because it is full of innovative leaders and teams. The pattern also indicates that the high level of organisational culture for innovation contributes to the high level of innovation diffusion outcomes, which in turn results in the high level of business performance. This was summed up by a comment from the senior structural engineer that the high level of the firm's innovativeness has helped it to maintain business growth as well as a high level of client satisfaction.

The pattern of relationships between constructs of Firm B indicates a partial match with the predicted pattern 2a. The level of leadership for innovation appears to highly correlate with that of team climate. Both constructs are also shown to correlate with the level of organisational culture for innovation, but with a slight weakening effect. The level of organisational culture for innovation, however, is not strongly associated with the level innovation diffusion outcomes as predicted, thus does not match the predicted relationship completely. Perhaps, this deficiency can be explained by the fact that the firm has recently

undergone a management restructure. According to the engineering manager who championed the restructuring process, such a change has started to drive the firm toward an improved culture for innovation by being more flexible and more inclined to the use of innovative approaches in carrying out its works. Finally, despite innovation diffusion outcomes being rated as low to medium, this construct was found to have a slight strengthening effect on business performance, which was rated as medium.

5. Discussion

The results from the quantitative analysis show that the developed conceptual model is partially supported by the data. Only two direct links from leadership and team climate for innovation to innovation diffusion outcomes are not significant. However, leadership and team climate for innovation appear to contribute to the outcomes of innovation diffusion indirectly through organisational culture. Such a pattern of relationships implies the mediating role of organisational culture that functions as a portal to an effective diffusion of new technologies and creative ideas. In addition, all the pathways to innovation diffusion outcomes appear to originate from leadership for innovation. This highlights a critical role that leadership plays in bringing about innovation through stimulating and motivating creativity in teams, whilst creating an innovation-conducive culture to support such creativity and foster innovation adoption. In addition, the results confirm the benefits of design innovation in helping to generate improved business performance in design firms as demonstrated by a significant relationship between the outcomes of innovation diffusion and business performance. By utilising advanced technologies and innovative design practices and being able to generate innovative design solutions, firms can enhance the quality of design processes and deliverables, thus increasing the level of client satisfaction and firm's reputation. This will in turn improve the ability to expand market share which ultimately leads to turnover and profit growth; thereby strengthening the overall business performance.

Regarding the results from the case studies, it appears that for Firm A the derived model can be used to adequately explain the actual relationships between the climate constructs and their contribution on innovation-related outcomes. In the case of Firm B, the results of pattern matching suggested that the model does not fully explain the actual phenomena. However, the degree to which the pattern of the observed constructs deviates from the pattern predicted by the model does not appear to be substantial when considering the possibility that the actual constructs might be affected by other factors, as evident from the presence of unexplained variance in the model. Reasonably, it can thus be concluded that the model derived from the quantitative analysis was adequately validated by the findings from the case studies.

6. Conclusions

This paper presents a study attempting to model the climate for innovation and its outcomes in respect to innovation diffusion and business performance of Australian AED firms. Specifically, the study highlights the roles and relations of three climate constructs, namely, leadership for innovation, team climate for innovation and organisational culture for innovation. The study was carried out using a mixed method design integrating questionnaire survey and explanatory case study research. The model derived from the SEM analysis of the survey data indicates that organisational culture for innovation appears to be a gateway to innovation diffusion by mediating the relationships between both leadership and team climate, and innovation diffusion outcomes. More importantly, the model suggests that to

create an innovative culture, a firm should place an emphasis on developing highly innovative leaders/supervisors. Although not directly influencing innovation, such leaders/supervisors could generate innovation indirectly by instigating creativity from team members and creating a supportive culture that nurtures innovative efforts. The study also found that the level of innovation diffusion outcomes significantly leads to an enhanced business performance, thus warranting the benefits of innovation in design firms. Finally, by using explanatory case study approach, the model was validated through two cases of Australian engineering design firms as it was found to reasonably explain the pattern of relationships between the constructs predicted by the developed model.

7. References

- Ahmed, P. K. (1998). *Culture and climate for innovation*, European Journal of Innovation Management, **1** (1), 30-43.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J. and Herron, M. (1996). Assessing the work environment for creativity, The Academy of Management Journal, 39 (5), 1154-1184.
- Aragón-Correa, J. A., García-Morales, V. J. and Cordón-Pozo, E. (2007). *Leadership and organizational learning's role on innovation and performance: lessons from Spain*, Industrial Marketing Management, **36** (3), 349-359.
- Ashfort, B. E. (1985). *Climate formation: issues and extensions*, The Academy of Management Review, **10** (4), 837-847.
- Bass, B. M. and Avolio, B. J. (1994). Improving Organizational Effectiveness through Transformational Leadership, Sage Publications, Thousand Oaks.
- Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences, 2nd edn, L. Erlbaum Associates, Hillsdale, N.J.
- Damanpour, F. and Gopalakrishnan, S. (1998). *Theories of organizational structure and innovation adoption: the role of environmental change*, Journal of Engineering and Technology Management, **15** (1), 1-24.
- Egbu, C. O., Henry, J., Kaye, G. R., Quintas, P., Schumacher, T. R. and Young, B. A. (1998). *Managing organizational innovations in construction*, Proceedings of the 14th Annual Conference Association of Researchers in Construction Management (ARCOM), ed. W. Hughes, Reading, 605-614.
- Ekvall, G. (1996). *Organizational climate for creativity and innovation*, European Journal of Work and Organizational Psychology, **5** (1), 105-123.
- Gable, G. G. (1994). *Integrating case study and survey research methods: an example in information systems*, European Journal of Information Systems, **3** (2), 112-126.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E. and Tatham, R. L. (2006). Multivariate Data Analysis, 6th edn, Pearson Prentice Hall, Upper Saddle River, N.J.
- Howell, J. M. and Higgins, C. A. (1990). *Champions of technological innovation*, Administrative Science Quarterly, **35** (2), 317-341.
- Hurley, R. F. (1995). *Group culture and its effect on innovative productivity*, Journal of Engineering and Technology Management, **12** (1-2), 57-75.
- Kozlowski, S. W. J. and Doherty, M. L. (1989). *Integration of climate and leadership:* examination of a neglected issue, Journal of Applied Psychology, **74** (4), 546-553.
- Lau, C.-M. and Ngo, H.-Y. (2004). *The HR system, organizational culture, and product innovation*, International Business Review, **13** (6), 685-703.
- Love, P. E. D., Holt, G. D. and Li, H. (2002). *Triangulation in construction management research*, Engineering, Construction and Architectural Management, **9** (4), 294-303.

- Montes, F. J. L., Moreno, A. R. and Morales, V. G. (2005). *Influence of support leadership and teamwork cohesion on organizational learning, innovation and performance: an empirical examination*, Technovation, **25** (10), 1159-1172.
- Nam, C. H. and Tatum, C. B. (1997). *Leaders and champions for construction innovation*, Construction Management and Economics, **15** (3), 259-270.
- Nicholson, G. J. and Kiel, G. C. (2007). Can directors impact performance? A case-based test of three theories of corporate governance, Corporate Governance, 15 (4), 585-608.
- Patterson, M. G., West, M. A., Shackelton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., Robinson, D. L. and Wallace, A. M. (2005). *Validating the organizational climate measure: links to managerial practices, productivity and innovation*, Journal of Organizational Behavior, **26**, 379-408.
- Rogers, E. M. (2003). Diffusion of Innovations, 5th edn, Free Press, New York.
- Salter, A. and Torbett, R. (2003). *Innovation and performance in engineering design*, Construction Management and Economics, **21** (6), 573-580.
- Schneider, B. and Reichers, A. E. (1983). *On the etiology of climates*, Personnel Psychology, **36** (1), 19-39.
- Steele, J. and Murray, M. (2004). *Creating, supporting and sustaining a culture of innovation*, Engineering, Construction and Architectural Management, **11** (5), 316-322.
- West, M. A. (1990), *The social psychology of innovation in groups*, in M. A. West and J. L. Farr (eds), Innovation and Creativity at Work, John Wiley & Sons, 309-333.
- West, M. A. (1997). Developing Creativity in Organizations, British Psychological Society, Leicester.
- Yin, R. K. (2003). Case Study Research: Design and Methods, 3rd edn, SAGE Publications, Thousand Oaks.
- Yukl, G., Gordon, A. and Taber, T. (2002). A hierarchical taxonomy of leadership behavior: integrating a half century of behavior research, Journal of Leadership and Organizational Studies, 9 (1), 15-32.