Effective TMO project workgroups: an investigation of antecedent conditions

Effective TMO Project Workgroups: An Investigation of Antecedent Conditions

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Abstract

In seeking to explain the antecedents of cross-functional TMO workgroup cooperation, Anvuur and Kumaraswamy (2007) [*Journal of Construction Engineering and Management*, 133(3), 225-34] proposed a conceptual framework which emphasizes the formative role of four factors: common goals; equal status; integrative interactions; and authority support. This study tests this framework empirically, based on responses from a Hong Kong survey of built environment professional managers and using structural equation modelling. The findings support the role of the four factors, showing that a superordinate construct—teamwork climate for cooperation—formed from the four factors significantly and positively influences workgroup members' in-role, extra-role, compliance, and deference behaviour. Therefore, project managers may usefully strive to create the generative project environments for the four optimal conditions for teamwork.

Keywords: Alignment, Cooperation, Cross-Functional Workgroup, Teamwork Climate, Temporary Multi-Organisation (TMO).

1. Introduction

Construction projects are complex adaptive systems involving many self-organising, differentiated yet complementary functional specialisms, which tend to be *across*—rather than within—firms and have high interdependencies in inputs, processes and outcomes (Hobday, 1998). The managerial imperative for joint-production in such temporary multi-organizations (TMOs) as coalitions (a nexus of contracts) becomes essentially one of cross-functional integration (Lawrence and Lorsch, 1967). This implies a shift in focus away from (management of) task execution (*taskwork*) and towards issues of coordination and cooperation (*teamwork*). Teamwork has been defined conceptually as "a set of interrelated cognitions, attitudes, and behaviours contributing to the dynamic processes of performance" (Salas *et al.*, 2008:541). Performance refers to the actual activity engaged in (the behaviour) which advances the goals of the social collective – *not* an appraisal of the outcomes of that activity, which is effectiveness (Dulaimi and Langford, 1999; Salas *et al.*, 2008). The question of how to foster effective teamwork in joint-production environments has attracted—and continues to attract—a lot of attention from researchers. One of the key discoveries of previous research in this area is that favourable (shared) cognitions about the work environment and its expected behaviour can promote teamwork and cooperation (DeChurch and Mesmer-Magnus, 2010; Mohammed *et al.*, 2010). Previous research also highlights the crucial role of training, coaching and facilitation (i.e. teambuilding activities) in creating and sustaining these favourable cognitions (Salas *et al.*, 2008). In the context of construction

projects, efforts at team-building take the form of interventions for socialization, focus on the creation of a conducive work environment and are broadly represented by the partnering ethos (Anvuur and Kumaraswamy, 2007).

Based on an extensive analysis and synthesis of the extant literature, Anvuur and Kumaraswamy (2007) developed a conceptual model of partnering and alliancing which emphasizes the formative role of four factors (properties of the work environment) in promoting effective teamwork and cooperation in TMO workgroups: common goals, equal status, integrative interactions, and authority support. The four factors are properties of the TMO workgroup environment and are distinct yet highly interrelated and mutually reinforcing concepts, thereby representing a superordinate latent construct (Law *et al.*, 1998), referred to this study as *teamwork climate for cooperation* (hereafter, teamwork climate). While the project (workgroup/team) environment has been identified in numerous conceptual and factor analytic studies of critical success factors for project effectiveness, and while other studies have also reported significant effects for one or another of the teamwork climate dimensions (Thamhain, 2004; Brookes *et al.*, 2006; Tuuli and Rowlinson, 2009), there has been to date no systematic empirical test of the effects of all four teamwork climate dimensions in a construction TMO workgroup setting—and this is despite the framework itself being welcomed by some. The purpose of this paper is to redress this by empirically investigating the proposition that teamwork climate significantly and positively influences TMO workgroup members' cooperative behaviours.

The framework proposed in Anvuur and Kumaraswamy (2007) is shown in Figure 1, except that "cooperative interactions" has been replaced with "integrative interactions for clarity and consistency in terminology. In this framework, the dominant construction industry conditions which were the original drivers for the partnering motif are depicted in the left-hand column. The four teamwork climate dimensions in column 3 are the *process benefits* from the implementation of the components of partnering in column 2 and lead, in turn, to the *content benefits* (e.g. cooperation, project effectiveness, innovation) in the right-hand column. Note that the content benefits are also mediated by many other cognitive and affective processes (e.g. interpersonal trust, positive affect, group identification). The focus of the present paper is to link, empirically, the four teamwork climate dimensions to individuals' cooperation with their TMO workgroups. The first dimension of teamwork climate, common goals, underscores the presence and salience of a normative goal frame, which motivates workgroup members to enact such behaviours as are necessary to advance the goals of the workgroup. The second dimension, equal status, underscores the presence of a workgroup environment characterised by mutual professional respect and equal opportunities for participation ('voice'). The third dimension, integrative interactions, emphasizes the presence of a workgroup environment characterised by participative safety and frequent interactions among workgroup members in joint decision-making and problem-solving. The final dimension, authority support, underscores the presence and abundance of senior management support—both articulated and enacted—for collaborative working. The four dimensions are interrelated and reinforcing. For example, when present, authority support helps to stabilize the normative goal frame in workgroup members through "goal contagion" effects and when absent, can create subversive undercurrents to any shared cognitions developed by workgroup members (Lindenberg and Foss, 2011).

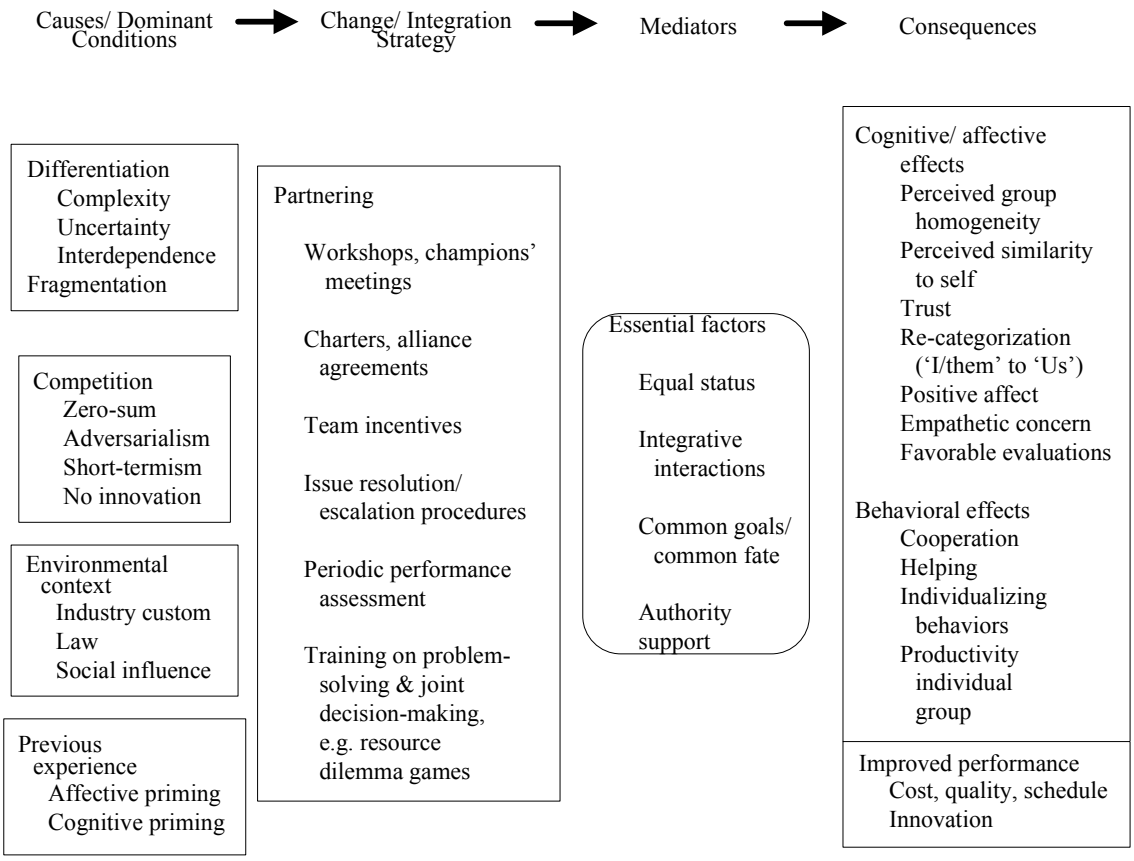

Figure 1: Conceptual model of partnering and its effects (Source: Anvuur and Kumaraswamy, 2007)

In this paper, hypotheses linking the superordinate teamwork climate construct to TMO workgroup members' cooperative behaviours are tested for corroboration using a Hong Kong sample. The individual level of analysis is adopted. Cooperation is conceptualized as individuals' performance behaviours which advance the goals of their proximal workgroups, and has four dimensions in terms of whether and to what extent role-incumbents creditably perform their work roles (*in-role*), go the extra mile and undertake extra task activities or help colleagues with their work-related problems (*extra-role*), adhere comprehensively to work-related rules and procedures (*compliance*), and defer to relevant authorities or 'best practice' standards of appropriate conduct where rules or norms are non-existent or vague (*deference*). The four performance behaviours are context-specific and constitute distinct, yet interrelated manifestations of the cooperation of individuals' with their workgroups. The construct validity and substantive utility of this four-dimensional cooperation model have been established in previous studies (e.g. Anvuur and Kumaraswamy, 2012; Anvuur *et al.*, 2012). The main proposition examined in this study can therefore be represented by the following four testable hypotheses:

Teamwork climate will significantly and positively influence TMO workgroup members' in-role behaviour (H_1)*, extra-role behaviour* (H_2)*, compliance behaviour* (H_3)*, and deference behaviour* (H_4).

In the sections that follow we describe our data collection method. We then describe our data analysis procedures, present the results of those analyses and discuss the implications of our findings for research and practice.

2. Method

2.1 Sample and procedure

The sample size was N = 140 and comprised built environment professional managers in Hong Kong. Average age of participants was 44 years. Average total experience of the participants in construction was 20 years and in current position, seven years. All but three participants had at least a bachelor's degree. The sample comprised 101 Chinese, 37 Caucasians and two participants of other ethnicities. The proportion of women managers in the sample (about 4%, n = 5) compares reasonably well with the total proportion of women employed in the Hong Kong construction sector (about 9%, see Hong Kong Census and Statistics Department, 2011).

Items for the present study were drawn from a larger Hong Kong questionnaire survey, data collection for which commenced in November 2006 and ended in March 2007. The questionnaire was sent out to 1100 potential respondents randomly drawn from a sampling frame for a study population defined using a purposive sampling procedure. Out of this number 153 valid responses were received, representing a response rate of 18% or the higher rate of 20% when adjusted for the 'non-eligibles' in the sampling frame. The questionnaire design, data collection and examination procedures for the survey are described in detail elsewhere (see Anvuur and Kumaraswamy, 2012; Anvuur *et al.*, 2012).

2.2 Measures

The variables of interest in this paper were measured with 33 scale items phrased as questionnaire items with Likert scale response formats. Instructions preceding the questionnaire items (save the demographic and social preference items) orientated respondents to focus on their role *and* proximal cross-functional workgroup within *one* and *the same* construction project that they were recently involved in within 5 years of survey date. Items measuring the four dimensions of individuals' cooperation with their workgroups (in-role, extra-role, compliance, and deference) are based on Anvuur and Kumaraswamy (2012) and were scored on a 5-point response format (1 = *never* to 5 = *very often*). *In-role* behaviour was measured using four items. A sample item reads 'I fulfil the responsibilities specified in my job description'. *Extra-role* behaviour was assessed with four items, for example, 'I volunteer to do things that are not required in order to help my workgroup'. *Compliance* behaviour was measured with three items. A sample item reads 'I comply with

work related rules and regulations'). *Deference* behaviour was assessed with three items, for example, 'I willingly follow my project organization's policies'.

The teamwork climate dimensions (integrative interactions, authority support, common goals, and equal status) were measured with 19 items each scored on a 5-point response format (1 = *strongly disagree* to 5 = *strongly agree*). *Integrative interactions* implies frequent interactions among workgroup members in joint decision-making and problem-solving, and was measured using four items adapted from the 'interaction frequency' subscale (α = 0.84) of Anderson and West's (1998) Team Climate Inventory (TCI). A sample item reads 'We meet frequently to talk both formally and informally'. *Common goals* was measured with six items adapted from the 11-item 'vision' subscale (α = 0.94) of Anderson and West's (1998) TCI. The TCI vision subscale reflects the extent of clarity, sharedness, attainability and importance of workgroup objectives, and is consistent with the conceptualization of common goals in the present study (e.g. 'I very much agree with my workgroup's objectives'). *Authority support* reflects the extent of support of the authorities, procedures and norms for joint decision-making and problem-solving in the workgroup. This was measured with six items adapted from Siegel and Kaemmerer's (1978) 'support for creativity' scale (split-half reliability = 0.94). A sample item reads ' Our ability to function cooperatively is respected by the leadership'. *Equal status* implies mutual recognition, appreciation of and opportunities for individuals' contributions to the workgroup effort. This facet was measured with four items adapted from Tyler and Blader's (2001) 8-item 'respect for work' scale (e.g. 'Colleagues in my proximal workgroup value what I contribute at work').

We also included controls for the effects of ethnicity, age, gender, and educational attainment in order to account for these possible alternative explanations for the cooperation of individuals with their TMO workgroups. The control variables were dummy-coded to test the effect of being Caucasian (i.e. other ethnicity = 0), older (i.e. ≤50 years = 0), female (i.e. male = 0), and holding a postgraduate qualification (i.e. bachelor's and below = 0) on in-role, extra-role, compliance, and deference behaviour.

3. Results

The two-step approach to structural equation modelling (SEM) (Anderson and Gerbing, 1992) was implemented using AMOS (Arbuckle, 2011). First, we performed a confirmatory factor analysis (CFA) to assess the fit to the data of our measurement model, which included the four dummy-coded control variables (ethnicity, age, gender, and education), the four cooperation dimensions (in-role, extra-role, compliance, and deference), and the four first-order constructs, integrative interactions, authority support, common goals, and equal status, loaded onto a the second-order super-ordinate latent construct called teamwork climate. Once a good-fitting CFA model was obtained, we then proceeded to specify and test a structural model containing the hypothesised relations between teamwork climate and the cooperation dimensions.

3.1 CFA

Maximum likelihood estimation was used to estimate the CFA model in AMOS, with each dummy-coded control variable fixed by assigning it an error variance of zero. Table 1 shows the construct reliabilities (CRs; the conceptual equivalent to Cronbach's alpha), interconstruct correlations and average variance extracted (AVE) estimates for the variables in the CFA model. Evidence of reasonable fit to the data of a CFA model of this complexity would include a significant χ^2 value, a normed χ^2 (i.e. χ^2/df) value below 5, comparative fit index (CFI) and incremental fit index (IFI) of 0.90 or higher, and root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR) of 0.08 or below (cf. Hair *et al.*, 2010).

The results of the analysis confirmed a good overall fit of the CFA model to the data: $\chi^2(df = 629) = 928.27$, $p = .000$; $\chi^2/df = 1.47$; SRMR = 0.065; RMSEA = 0.059; IFI = 0.91; CFI = 0.91. Good convergent validity is generally indicated by (Hair *et al.*, 2010): statistically significant factor loadings of 0.50 or higher; AVE estimates of 0.50 or higher; and CR estimates of 0.70 or higher. All standardized factor loadings ranged from 0.61 to 0.97, and all freely estimated loadings were statistically significant, $p = .000$. The factor loadings for the second-order teamwork climate construct were substantially high (integrative interactions, $\lambda = 0.76$; authority support, $\lambda = 0.88$; common goals, $\lambda = 0.75$; equal status, $\lambda = 0.75$). The CR estimates for all latent constructs were substantially higher than the threshold value of 0.70, thus suggesting adequate reliability. Except for extra-role, with an AVE estimate of 0.47, all AVE estimates in Table 1 exceeded the threshold value of 0.50. The below-threshold AVE estimate for extra-role is despite its substantially high CR estimate of 0.86. However, it is not uncommon for acceptably reliable latent constructs to have below-threshold AVE estimates (Hair *et al.*, 2010). Overall, however, the evidence supports the convergent validity of the CFA model.

Discriminant validity is demonstrated if the AVE for each construct is greater than its shared variance (i.e. squared correlation) with any other construct (Hair *et al.*, 2010). The discriminant validity of the CFA model is demonstrated in Table 1 where it is clear to see that each AVE estimate is greater than the squared interconstruct correlations in the row and column in which it is found. The pattern of statistically significant, positive correlations among latent constructs in Table 1 ($r \geq 0.22$, $p < .05$), consistent with theoretical expectations, provides evidence of nomological validity on a zero-order basis. Of the four control variables, ethnicity was significantly associated with extra-role behaviour ($r = 0.19$, $p < .05$) and compliance ($r = 0.20$, $p < .05$), age was significantly related to gender ($r = –0.19$, $p < .05$), and education was significantly associated with compliance ($r = 0.19$, $p < .05$).

3.2 SEM

Having established satisfactory fit of the CFA model to the data, we proceeded to test the structural model for corroboration (or otherwise) of hypotheses H_1 through to H_4. The SEM model also included paths from each of the four control variables (ethnicity, age, gender, and education) to in-role, extra-role, compliance, and deference behaviour. The results suggested a good fit of the SEM model to the data: $\chi^2(df = 634) = 970.42$, $p = .000$; $\chi^2/df = 1.53$; IFI = 0.90; CFI = 0.90; SRMR = 0.08; RMSEA = 0.06 with a 90% CI of (0.05, 0.07), $p = .008$. The structural model is shown in Figure 2. To avoid visual clutter, error terms for factor

loadings, disturbance terms for latent constructs, as well as all the objects, names and parameters associated with the four control variables are not displayed in Figure 2. Scale items for first-order constructs in are represented in Figure 2 by numbers (1–34). All coefficients for the variables of interest in Figure 2, including path coefficients and freely estimated factor loadings were statistically significant at $p < .05$. The stability of parameter estimates between the CFA and SEM models (allowing for the expected insignificant factor loading fluctuations of ≤ |0.05|) provides further evidence of discriminant validity.

Table 1: Construct reliabilities, interconstruct correlations, and variance extracted estimates

Construct	CR	1	2	3	4	5	6	7	8	9
1. Compliance	0.95	0.72								
2. In-role	0.95	0.40[c]	0.67							
3. Extra-role	0.86	0.32[b]	0.61[c]	0.47						
4. Deference	0.89	0.67[c]	0.30[b]	0.33[b]	0.61					
5. Teamwork climate	0.94	0.22[a]	0.35[c]	0.52[c]	0.22[a]	0.62				
6. Ethnicity	1.00	0.20[a]	0.00	–0.06	0.19[a]	0.16	1.00			
7. Age	1.00	0.01	0.00	0.04	–0.05	0.09	–0.10	1.00		
8. Gender	1.00	0.05	–0.04	–0.07	0.04	0.02	0.03	–0.19[a]	1.00	
9. Education	1.00	0.19[a]	0.01	–0.01	0.15	0.07	0.01	0.04	0.02	1.00

Note. $N = 140$. CR, Construct Reliability. Entries below the diagonal are correlations among constructs. Diagonal entries are average variance extracted (AVE) estimates. Ethnicity. Age, gender and education were dummy-coded to test the effects of being Chinese (Other ethnicity = 0), older (≤ 40 years = 0), female (male = 0), and holder of a postbachelor's qualification (bachelor's degree or below = 0).
[a]$p < 0.05$
[b]$p < 0.01$
[c]$p \leq 0.001$

Except the effect of education on compliance behaviour (not shown in Figure 2) which was statistically significant and positive ($\beta = 0.17$, $p = .037$), no significant effects were found for the other control variables. We found support for our substantive hypotheses. Hypothesis H_1 predicted that teamwork climate will significantly and positively influence in-role behaviour. This was supported, as the structural path from teamwork climate to in-role behaviour (see Figure 2) was statistically significant and positive ($\beta = 0.45$, $p = .000$). The results in Figure 2 also show that: teamwork climate is significantly and positively related to extra-role ($\beta = 0.62$, $p = .000$), compliance ($\beta = 0.23$, $p = .015$), and deference behaviour ($\beta = 0.24$, $p = .019$). Therefore, hypotheses H_2, H_3 and H_4 were also supported.

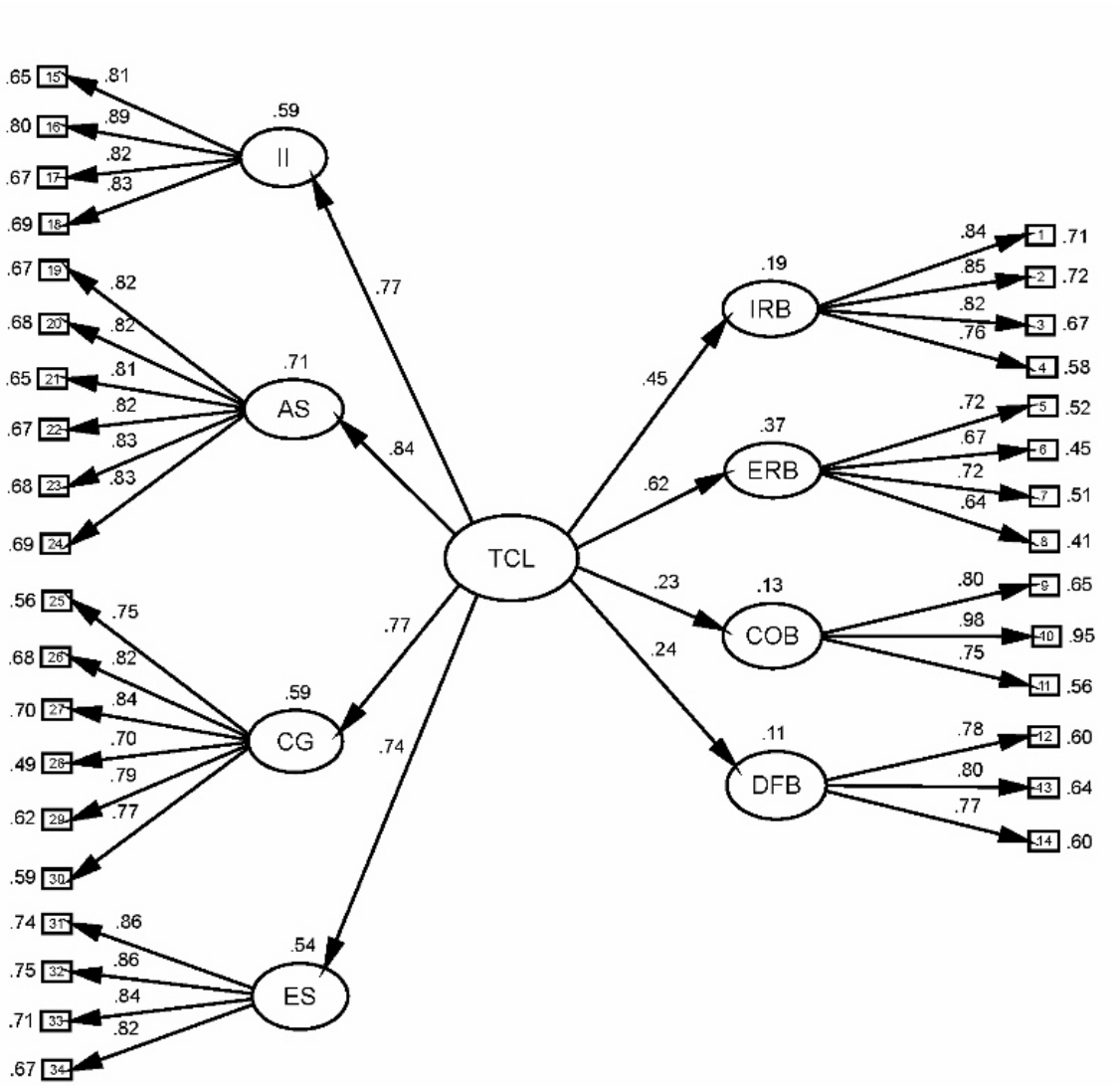

Figure 2: Structural equation modelling results

N = 381. e = error term; d = disturbance term. χ^2(*df* = 634) = 970.42 and χ^2/*df* = 1.53, *p* = .000; IFI = .90; CFI = .90; SRMR = .08; RMSEA = .06. All standardized coefficients are statistically significant at *p* < .001, and are from analyses that included dummy-coded controls for the effects of ethnicity (Non-Chinese = 0), age (≤ 40 years = 0), gender (male = 0) and educational attainment (bachelor's and below = 0) on in-role, compliance, extra-role, and deference behaviour. Education had a significant effect on compliance behaviour (*β* = 0.17, *p* = .037). No significant effects were found for the other control variables. II, Integrative Interactions; AS, Authority Support; CG, Common Goals; ES, Equal Status; IRB, In-role Behaviour; ERB, Extra-role Behaviour; COB, Compliance Behaviour; DFB, Deference Behaviour.

4. Discussion and conclusion

The results show that teamwork climate significantly and positively influences all four dimensions of role-incumbents' cooperation with their TMO workgroups. Thus, if TMO workgroup members perceive a shared sense of purpose, mutual professional respect, integrative interactions, and senior management support for collaborative working—a teamwork climate—they are likely to be spurred on to engage in more in-role, extra-role, compliance, and deference behaviour. These findings provide sound empirical support for the conceptual model proposed in Anvuur and Kumaraswamy (2007). The findings are also consistent with those of previous research that investigated the performance consequences of aspects of the workgroup environment in projects. For example, Thamhain (2004) found that the project team environment—operationalized as including factors such as professional recognition, respect, and senior management support—positively influenced the performance of the 76 IT project teams he surveyed. Tuuli and Rowlinson (2009) found that empowerment climate positively influenced the in-role and extra-role behaviours of members of the 115 construction project teams they surveyed. Their conceptualization of empowerment climate—as consisting of access to opportunity, information, resources, support, informal power and formal power—is consistent with the conceptualization of authority support in this study. In their study about the social network basis of knowledge management in project contexts, Brookes *et al*. (2006) found that professional respect was significantly correlated with the effective sharing of information and knowledge among workgroup members (i.e. relationship "conductivity"), which is required for effective joint-production in new product development projects.

The findings of this study provide support for modelling the four properties of the TMO workgroup environment (common goals, equal status, integrative interactions, and authority support) as dimensions of a superordinate construct, here teamwork climate. There is also support for this in the extant literature. For example, based on an extensive meta-analysis of previous studies, Pettigrew and Tropp (2006) concluded that the four teamwork climate dimensions—originally proposed by Allport (1954) as the optimal conditions for reducing racial and ethnic prejudice in intergroup encounters—were applicable to other groups, and were best conceptualized as an "interrelated bundle". Consistent with this view and proceeding from different conceptual antecedents, Carson *et al*. (2007) modelled the internal team environment as a superordinate construct consisting of shared purpose, social support, and voice, and investigated its effects on shared leadership in the MBA consulting teams they studied. Their definition of shared leadership—as distributed leadership influence among team members in areas related to direction, motivation and support (Carson *et al.*, 2007:1218-9)—is consistent with the conceptualization of extra-role behaviour as including helping workgroup colleagues with their work-related problems. Carson *et al*. (2007) found that the internal team environment positively influenced shared leadership. The significance of being able to model teamwork climate as a second-order factor reflected by common goals, equal status, integrative interactions, and authority support is that this provides theoretical parsimony and bandwidth (Law *et al.*, 1998; Edwards, 2001). However, as support for a multidimensional construct should be by exception rather than the norm (Edwards, 2001), future research could usefully investigate the utility of modelling the multidimensional teamwork climate construct as a superordinate construct—rather than by its set of dimensions—in other TMO workgroup contexts.

The usual limitations of a study of this kind, deriving principally from the self-report nature of the data, sample demographics and location specificity (Hong Kong) are best left to future research to address, and were mitigated in part in this study through statistical controls. These limitations notwithstanding, the findings of this study should be instructive to project managers trying to create and sustain high-performance project teams. If, as our results suggest, creating a TMO workgroup environment in which project actors perceive a shared sense of purpose, recognition for their professional contributions, experience joint-decision making and problem-solving, and the support of the authorities, workgroup and TMO norms is sufficient to tap into the full spectrum of individuals' cooperative behaviours, then project managers need to be heedful of these four teamwork climate dimensions.

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