VALIDATION OF A MODEL FOR ASSESSING ALLIANCE TEAM INTEGRATION

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An approach towards fostering continuous team integration practice in project alliancing is essential for stimulating breakthrough outcomes. However, until recently there was no standard or systematic approach for measuring the integration practice over the life cycle of alliance projects. This paper presents such an assessment model, the Alliance Team Integration Performance Index (ATIPI), to measure the current state of the team integration performance. With the aid of a panel of alliance experts, seven dominant key indicators (KIs) with their respective quantitative measures (QMs) and performance scales were identified for inclusion in the ATIPI. As the focus of this paper, a means of examining the validity of the model is demonstrated through the use of the face validity method with a panel of experts in the field of project alliancing. The results indicate that the proposed assessment model was found to be applicable in objectively measuring team integration performance. Based on the lessons learned from the expert's interviews, the reliability of the model could be further enhanced in order to enable owner and non-owner participants to gain an insight into the team integration performance consistently and objectively.

Keywords: alliance, team integration, validation, New Zealand.

INTRODUCTION

Project alliancing is regarded as a potential panacea for enhancing integration efforts in the construction industry (Love *et al*., 2010; Chen *et al*., 2012). However, in spite of the fact that a high level of integration is a widely understood feature of the alliance model, the ability to sustain and consistently drive the integration practice to achieve the desired outcomes is of on-going concern (Laan *et al*., 2011). One possible explanation for the on-going concern is that project teams are frequently isolated in environments where adversarial cultures and attitudes still exist (Laan *et al*., 2011). In addition, some individuals may experience culture shock in the new environment, and coping within a new challenging project environment may contribute to the difficulty to integrate proactively and to move away from the traditional adversarial approach (Reed and Loosemore, 2012). This phenomenon potentially occurs because the principle of the alliance model is yet to mature for some industrial players (Yeung *et al*., 2007) and the need for alliance team members to possess different attributes than those involved in business-as-usual (BAU) in order to strengthen the sources of integrated practice (Ibrahim *et al*., 2013).

Against this background, the need for consistent integration practice over the lifecycle of an alliance project, mentioned by previous scholars, assumes a special significance to enhance the continuity of the integration within the alliance teams. For countries

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such as Finland and New Zealand, where the level of maturity in the alliance model is now gathering pace in the industry, it is critical that a means of understanding team integration practice, more importantly, how to drive continuous and consistent performance in this area, is vital to its continued success. Although prior research on team integration emphasized the importance of measuring integration practice, the findings only focused on subjective assessment rather than empirical evidence. For example, Baiden *et al*. (2006) focused on assessing the extent of team integration in Design and Build (DB) and construction management procurement approaches. They concluded that either an integrated team is necessary, or the industry must overcome the existing adversarial culture, for project performance to be improved. Some other researchers, Aapaoja *et al*. (2013) by contrast, examined the level of team integration practice in building projects procured by the integrated project delivery (IPD) method. They emphasized that due to the integrated nature embedded in the IPD method, projects can be successful although some of the integration characteristics are not fully achieved.

Despite the aforementioned research, the issue of assessing team integration practice objectively, remains elusive. Although these studies made significant progress in assessing the integration practice, they mainly attempt to reveal evidence of the integration practice using a subjective assessment (e.g. fully integrated, partly integrated) rather than trying to assess the practice objectively over time. As a result, it is very difficult to quantify an actual measure for team integration based on these findings. Recognising that there are no standard or accepted methods in the industry to assess the alliance team integration performance, Ibrahim *et al*. (2013) have developed an assessment model, the Alliance Team Integration Performance Index (ATIPI) for assessing alliance team integration performance. However, whether the assessment tool is valid and performs its intended function for the use of industry, should be determined through a process of validation. The validation process, in research in the construction domain, is a fundamental element of the process of scholarly endeavour (Lucko and Rojas, 2010).

The purpose of this paper is to presents the validation process of the ATIPI model through an interview with thirteen alliance practitioners, based on six validation aspects. Consequently, the subsequent sections of the paper briefly provide an overview of the development of the ATIPI model. Further details on the research and development of the ATIPI model can be found in Ibrahim *et al*. (2013, 2014, 2015). Then, the research method is introduced and findings of the validation interview sessions are analysed. Finally, the discussions are presented, followed by the conclusions.

ATIPI MODEL STRUCTURE

As summarized in Figure 1, the development framework for the ATIPI model consists of three phases including Key Indicator (KI) identification, Quantitative Measure (QM) identification, and the range of scales for five performance levels.

Phase 1: The most significant Key indicators, signifying their dominant influence

In Phase 1, four rounds of Delphi questionnaire survey were undertaken with a panel of 17 experienced alliance practitioners to identify and weight the most significant KIs to measure the success of alliance team integration in road construction projects. Over the course of the Delphi survey, the seven most significant KIs were identified, as follows: (1) team leadership; (2) trust and respect; (3) a single team focus on project

objectives and Key Result Areas (KRAs); (4) collective understanding; (5) commitment from project alliance board; (6) creation of single and co-located alliance team; and (7) free flow communication (see Ibrahim *et al*. (2013) for a detailed discussion). The ATIPI was then developed based on the preceding KIs and their weightings, as shown for Phase 1 in Figure 1.

PHASE 1

ATIPI = 0.250 x Team Leadership + 0.214 x Trust & Respect + 0.179 x Single Team Focus on Project Objectives and KRAs + 0.143 x Collective Understanding + 0.107 x Commitment from Project Alliance Board + 0.071 x Creation of Single and Co-located Alliance Team + 0.036 x Free Flow Communication

PHASE 2

(K1) Team Leadership: *Measuring the Time & Cost performance: Variation of actual time / cost against programme / budget expressed as a percentage of the project's progress;*
(K2) Trust and respect: *Survey of wider alliance teams' satisfaction on the level of trust and respect by using a Likert scale;*
(K3) Single team focus on project objectives and KRAs: *Survey of wider alliance teams' understanding on the project objectives and KRAs by using a Likert scale;*
(K4) Collective understanding: *Percentage of alliance team attendance in weekly project briefing;*
(K5) Commitment from PAB: *Percentage of PAB members (original) attendance in PAB meetings;*
(K6) Creation of single and co-located alliance team: *Number of staff allocated on-site against the overall number of staff expressed as a percentage of the single and co-located alliance team;*
(K7) Free flow communication: *The turnaround time for Request for Information (RFI) and Design Engineering Instruction (DEI).*

PHASE 3

KI	Range of Scales of the Performance Levels for each KI				
	Poor	Average	Good	Very Good	Excellent
KI 1	< -7.5%	≥ -7.5% to <0%	≥ 0% to <8.2%	≥ 8.2% to <16.8%	≥ 16.8%
	< -3.4%	≥ -3.4% to <1%	≥ 1% to <6%	≥ 6% to <10%	≥ 10%
KI 2	< 5.6	≥ 5.6 to <6.9	≥ 6.9 to <8.25	≥ 8.25 to <9.5	≥ 9.5
KI 3	< 5.5	≥ 5.5 to <6.7	≥ 6.7 to <8.1	≥ 8.1 to <9.5	≥ 9.5
KI 4	< 66%	≥ 66% to <80.5%	≥ 80.5% to <89.5%	≥ 89.5% to <96%	≥ 96%
KI 5	< 70.5%	≥ 70.5% to <79.5%	≥ 79.5% to <87.5%	≥ 87.5% to <95.5%	≥ 95.5%
KI 6	< 67.5 %	≥ 67.5% to <78%	≥ 78% to <87%	≥ 87% to <96%	≥ 96%
KI 7	> 7.75	≤ 5.6 to >7.75	≤ 4 to >5.6	≤ 1.5 to >4	≤ 1.5

Figure 1: Development Phases of the ATIPI Model

Phase 2: The suitable Quantitative Measures (QMs) for each of the KIs, to promote objective assessment over time

Once the significant KIs for alliance project teams were identified from Phase 1, the next level of development of the model, Phase 2, involved identification of appropriate measures, in order to promote objective assessment over time for those seven KIs. Consequently, in Phase 2, a semi-structured interview with five experienced alliance practitioners was conducted to identify suitable, practical and objective measures to help evaluate the seven selected weighted KIs. As a result, a

total of 29 quantitative measures (QMs) were proposed and recommended. Then, two rounds of Delphi questionnaire survey were undertaken with the same 17 Delphi experts to identify the most appropriate QMs for each KI based on their levels of importance, measurability and obtainability (See Ibrahim *et al*. (2014)).

Phase 3: The performance level boundaries for each KI, to reduce the subjectivity of assessment and promote consistency

The next level of development of the model, Phase 3, involved the development of an associated range of scales for each KI to indicate the boundaries of the different performance levels in the ATIPI. The performance levels establish the points at which alliance teams have demonstrated sufficient integration practice to be regarded as performing at a particular achievement level. Accordingly, Phase 3 of the model development included a systematic procedure based on a questionnaire survey and fuzzy set theory, namely the modified horizontal approach with bisector error method, to establish a range of scales for each QM within five levels of performance. The five performance levels designated are excellent, very good, good, average and poor. Although the ATIPI has been verified to be functioning to perform its intended purpose (see Ibrahim *et al*. (2015)), the availability of a computerized rather than manual assessment tool is vital to encourage its uptake in the industry.

The ATIPI excel spreadsheet was made available for download as open software via an established free file hosting website at the following link: http://www.mediafire.com/view/3p1jbkr76ctx8e0/ATIPI_Demo_Final_AiC.xlsx. The tool is still a prototype model and currently only allows entry of one set of assessment data. The following section describes the validation of the model to measure the integration practice in alliance projects.

VALIDATION OF THE ATIPI MODEL

Research in performance measurement, in particular in the construction domain, has gained increasing attention over the past few decades. Two research studies, in particular, are highlighted here, namely Chow and Ng (2007) who developed the consultants performance evaluation (CPE) model using a gap analysis technique and Ng and Skitmore (2014) who developed the subcontractor appraisal performance using a balanced scorecard. It is worth noting that although these three studies each use different techniques to develop the performance model, they all use the same type of validation, that is face validity, to validate their respective models. Face validity is based on subjective judgement, is non-statistical in nature, and requires the opinion of non-researchers regarding the validity of a study (Leedy and Ormrod, 2001). For example, a specific model can be said to have face validity if the experts in the respective field analyse the model and its output represents, to a high degree, what happens in reality. In a domain such as construction management and engineering, collaboration with appropriate representatives from private and public sectors is vital to secure the face validity of the study (Lucko and Rojas, 2010).

RESEARCH METHOD

In this study, the face validity approach, using a structured interview technique, was adopted to validate the ATIPI. The ATIPI model was validated by a total of 13 alliance practitioners including five alliance experts used in the Delphi study (referred to as Internal Experts) and another eight experienced alliance practitioners (referred to as External Experts) who had not previously participated in the development of the ATIPI, as shown in Table 1.

Table 1: Profile of alliance practitioners who participated in the model validation process

Experts	Position	Organization
1*	Design Manager	Consultant
2*	General Manager	Consultant
3*	Project Controls Manager	Consultant
4*	Chief Advisor	Client
5*	Alliance Manager	Contractor
6	Communication Manager	Client
7	Design Manager	Consultant
8	Quality Assurance and Systems Manager	Contractor
9	Project Director	Consultant
10	Sub Alliance Manager	Contractor
11	Consents Assurance and Key Results Manager	Client
12	Project Controls Manager	Contractor
13	Owner Interface Manager	Client

Note: * Internal Experts who had participated in developing the ATIPI

The eight external experts were selected based on two criteria: (1) Pertinent / Relevant and verifiable previous experience in alliancing projects in New Zealand; and (2) Having recent/on-going and direct involvement on a Project Alliance Board (PAB) or Alliance Management Team (AMT). O'Leary (1987) emphasised that using internal experts in the validation process will ensure that the model has captured their expertise and that the experts have thought about what it takes to structure the model. In contrast, using external experts offers advantages such as the potential for another point of view and a test of unstated assumptions in the model. Moreover, Yeung *et al*. (2009) argued that having independent or different validators will ensure no biased validation results exist. Thus, incorporating the views of different validators will ensure an equitable and reliable validation process. Although previous scholars like Chow and Ng (2007) and Yeung *et al*. (2009) used 8 and 7 validators, respectively, for their model validation, this study used 13 validators to help ensure a rigorous validation. In addition, having a balance of organisations represented among the experts; consultant (38.4%), contractor (30.8%) and client (30.8%), will help prevent bias. Moreover, the 13 experts have more than 6 years of experience on average, at management level specifically in alliancing contracting and more than 15 years in collaborative arrangements, which indicates they are highly qualified and capable to carry out the validation.

Results and Analysis

A qualitative methodology by using structured face to face interviews has been used as the research approach for this validation study. Initially, the validators were briefed on the aim and objectives of the study and then guided through the overall integration of KIs, QMs and the range of scales for performance levels for inclusion into the development of the ATIPI model. Validators were then invited to provide an evaluation of the ATIPI model through a scoring sheet. In total, six aspects were validated including; *1) Degree of appropriateness*: The relevancy of the KIs, QMs and ranges of scales for Performance Levels included in the ATIPI; *2) Degree of objectivity*: The degree of objectivity in the assessment; *3) Degree of replicability*: The ability of the tool to be replicated or used on other alliance projects; *4) Degree of practicality*: The level of practicality of the tool to be used in actual alliance projects; *5) Overall reliability*: The ability of the ATIPI to consistently perform its intended

function; and *6) Overall suitability to be adopted as an assessment tool*: The suitability of the ATIPI to be adopted as an assessment tool to measure the team integration performance of alliance teams.

They were asked to provide a score on a validation scoring sheet according to a 5-point Likert scale (1 representing 'not at all satisfied' to 5 representing 'extremely satisfied') to signify their extent of satisfaction on each of the validation aspects. The results of validation of the ATIPI model are summarized in Table 2, in which the rating of each expert and mean ratings of each validation aspect are shown.

Table 2: Validation results based on responses of 16 alliance validators

Validation Aspect	Alliance Validators													Mean rating
	1*	2*	3*	4*	5*	6	7	8	9	10	11	12	13	
Degree of Appropriateness	3	4	4	3.5	5	4	4.5	4	3	3.5	4	4	4	3.88
Degree of Objectivity	4	4	4	3.5	4	5	3.5	5	4	4	4	3	4	4.00
Degree of Replicability	4	5	4	5	4	4	5	5	4	5	4	4	4	4.38
Degree of Practicality	4	4	4	4	5	4	3	5	4	4	4	3	4	4.00
Overall Reliability	3	4	4	5	3	4	4.5	5	4	3.5	4	3	3	3.85
Overall Suitability	3	3	4	4	5	3	4	5	3	4	4	3	4	3.77

Note: 1= Not at all satisfied and 5=extremely satisfied

* Internal Experts who had participated in developing the ATIPI

The validation results show that the *Degree of Appropriateness* received a mean rating of 3.88 indicating the extent of experts' satisfaction on the relevancy of the characteristics of the ATIPI is 'satisfied towards very satisfied'. The second validation aspect in terms of *Degree of Objectivity* of the ATIPI received a response 'very satisfied' with a mean rating of 4.00. The majority of the experts believed that the ATIPI is an objective assessment tool to measure the alliance team integration, as the majority of the QMs are quantitative in nature and characteristic, and, hence, influence the objectiveness of the tool. Next is the third validation aspect, the *Degree of Replicability* which received a 'very satisfied to extremely satisfied' (mean rating of 4.38) response among the experts on the ability of the tool to be replicated on other alliance projects. The fourth validation aspect, *Degree of Practicality*, received a mean rating of 4.00, resulting in a 'very satisfied' response among the experts. *Overall Reliability* is the fifth validation aspect and received a satisfaction response of 'satisfied towards very satisfied' with a mean rating of 3.85. Again, due to the characteristics of the ATIPI, most of the experts believe the tool has the ability to consistently perform its intended function, although some experts believe it needs to be tested and piloted in practice on a numbers of alliance projects and over the lifecycle of the projects to be absolutely sure of its reliability. The final validation aspect is the *Overall Suitability*, which received a mean rating of 3.77, thus indicating a response of 'satisfied towards very satisfied'.

Overall, it is worth noting that high ratings (mean rating ≥ 4.0) were achieved for 'degree of objectivity', 'degree of replicability' and 'overall practicality' and a mean rating of greater than 3.7 and less than 4.0 was achieved for *"the degree of appropriateness, degree of reliability and overall suitability"*. It should be highlighted that, in accordance with studies such as Chow and Ng. (2007) and Yeung at al. (2009), mean ratings greater than 3.5 are adequate to warrant validation of a model. To summarize, the validation results have confirmed that the ATIPI model could assist in assessing the alliance team integration performance in road infrastructure projects. In addition, any variability in responses between the internal and external experts did not affect the validation aspects of the ATIPI, as the responses from both categories of experts were consistent based on mean responses.

DISCUSSION

The findings of the research revealed that the ATIPI model could potentially assist in assessing the alliance team integration performance in road infrastructure projects. However, it is worth highlighting that every performance model has its own limitations which can be exacerbated, unless methodological considerations are carefully selected and applied under suitable settings (Yang *et al*., 2010). Some issues were highlighted and possible improvements were suggested during the validation in order to enhance the applicability of the model to real alliance projects. Notably, during the validation process, the strength of the model was called into question specifically upon the assessment of QMs for the respective KIs. In particular, concerns related to how a single QM could directly measure what can be a complicated KI. For example, as critiqued by some of the experts, how cost and schedule performance could fully represent the KI of team leadership, which is more abstract and hard to quantify. Grint (2005) stated that the basic definition of leadership has yet to be agreed, l*et al*one whether it can be measured, despite vast research into application of leadership skills to project teams (Walker, 2015). Although the QM for team leadership was questioned in the validation, some research studies in the construction domain indicate that there is a relationship between cost and schedule performance and leadership. Lendrum (2011) stated that cost and time improvement are seen as value propositions underpinning alliancing that linked directly with leadership styles and characteristics. In fact, Yang *et al*. (2011) found that there is an interrelationship between shared leadership and project success due to project complexity. They emphasized that projects were more likely to be successful when they experienced high levels of shared leadership. The complexity to quantify such an input for the QM, has lead the experts to choose a measure based on ease of measurement and obtainability to address those indicators (Ibrahim *et al*., 2014). Overall, the validation experts believe that while the recommended QMs covered the range of possibilities of appropriate QMs, the final selection may have been influenced by the experience of the alliance experts in measuring such an indicator in their alliance projects.

A key consideration in developing the ATIPI was to ensure that it was a practical and useable model. To that end it was decided to include only one QM for each KI. However, as proposed during the validation, this is a potential limitation, in that certain aspects of the KI may not be captured effectively with just one QM. The issue on the capacity to have more than one QM for each KI is desirable based on comments by the experts, as it may provide greater coverage of the influencing factors for the KI. For example, the establishment of a lead and lag QM, with a combination of quantitative and qualitative measures, if applicable, for each KI would help to enhance the characteristics of the assessment tool. Yeung *et al*. (2013) described that ability to incorporate leading and lagging performance indicators will provide

early warnings, identify possible problems that could lead to opportunity for organizational change.
In addition, demonstrating the application of the model in real life was suggested to ensure the applicability of the model. Experts also suggested that the frequency of the assessment should be on a quarterly basis, rather than monthly, to allow time for variation in the data and, hence, provide sufficient time for managerial teams to measure, analyse and respond to the performance. A longitudinal study to assess the alliance integration performance in different stages of alliance projects is proposed. Results from these studies will assist with the development of a more complete and accurate team integration performance database. In addition, factors that might affect the integration performance identified during the demonstration of the model (e.g. complexity of the project, size and characteristics of the alliance teams), could also be addressed in a longitudinal study. Such studies would help to refine the measurement indicators or reveal other key indicators which can impact on team integration and isolate the lessons learned and best practices from different types of alliances. Such findings could be integrated in the ATIPI as guidance for continuous improvement.

While the development of the ATIPI into an online model is beyond the scope of this study, the experts recommended that further enhancement of the model's functionality with more adaptive capabilities and the establishment of an integrated online-based platform is undertaken. Thus, administration of the domain knowledge of the model can be enhanced and the assessment and monitoring process will to be openly accessible to authorized alliance managerial teams.

Comparison to related studies on integrated index model in construction research

The establishment of the ATIPI model in this study presents an opportunity for comparison with for other types of index model. For example, Cheung *et al*. (2003) developed the system for monitoring the status of partnering in Hong Kong through the use of an index, based on the incorporation of an established partnering measure. Yeung *et al*. (2007) focused on measuring the overall performance of a partnering project in Hong Kong, by establishing a specific key performance indicator (KPI) through the use of Delphi method. In contrast, Xia and Chan (2012) focused on assessing the degrees of project complexity in China by identifying the complexity measures for building projects. Overall, although aforementioned studies were based on the same concept, they are all different in terms of their focus, scope, methodology as well as the validation process, and hence result in different outcomes.

The validation of the ATIPI confirm that the model provide an automated way of assessing in terms of collecting, retrieving and presenting graphically empirical data (i.e. objective results) to assist in managing the integration practice consistently and continuously. Such assessments could lead to recognition of pattern variations, which in turn lead to identification of which indicators are dominant to their integration practice, thereby focusing alliance managerial team attention and reach much faster on those that will have the greatest impact in terms of its strengths and weaknesses and plan ahead for improvement. Waiting until the end of the project for analysis and reports is no longer a practical management strategy in delivering complex projects. It is worth noting that the ATIPI is not a direct measure of successful team performance, as a whole. Rather, it is a proactive management approach focused on measuring team integration performance consistently and objectively.

Overall, the ATIPI model provides an alternative methodology to the existing approach outlined in the literature for assessing the team integration, which is

subjective and limited to non-collaborative arrangements, with little focus on making the assessment objective and systematic.

CONCLUSIONS

The ATPI aims to be a platform for teams to reflect and discuss how their team relates to each of the indicators and the impact of this on their integration practice. In addition, the ATIPI captures key insights into team performance and, hence, provides a point of reference to drive continuous improvement.

This paper presented the validation of the ATIPI. The findings confirm that the ATIPI is a simple and user-friendly assessment tool that enables alliance teams to self-diagnose and better understand the current state of their team integration performance over the course of the project. This is further supported by the positive validation feedback given by a selection of alliance experts, although some improvements based on the expert's interviews could be incorporated to further improve certain features of the model, thereby facilitating its application in the alliancing industry. In addition, the validation of the ATIPI could possibly be further expanded in future by testing its application on different project stages on a number of on-going alliance projects, not only in New Zealand but in other countries. Such studies would help to enhance the model in terms of integrating the best practices from different types of alliances, and hence, improve the project outcomes.

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