

A COMPONENTIAL MODEL OF COLLABORATIVE INNOVATION

Tania Bucic

University of Technology, Sydney
Faculty of Business
City Campus Haymarket
PO Box 123 Broadway
NSW 2007 Australia
Tel.:+61 2 9514 3530
Fax.:+61 2 9514 3535
Tania.Bucic@uts.edu.au

Siegfried P. Gudergan

University of Technology, Sydney
Faculty of Business
City Campus Haymarket
PO Box 123 Broadway
NSW 2007 Australia
Tel.:+61 2 9514 3530
Fax.:+61 2 9514 3535
Siggi.Gudergan@uts.edu.au

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INTRODUCTION

Companies face the simultaneous challenge of collaborating and coordinating with other businesses to provide unique and novel solutions. While the coordination of such alliances presents challenges in itself, the management of innovation within these relationships becomes more problematic. This leads to the question: Why are some businesses more innovative in collaborative settings than others? Hence, developing a better understanding of the process of innovation in alliances is crucial for the management of alliances.

This paper is an extension of earlier work by Bucic and Gudergan (2002). Their model specifies the direct and mediated effects that explain innovation within alliances. The model shows that alliance creativity, alliance learning and alliance knowledge stock drive alliances innovation; the latter is labelled *chain of innovation*. Moreover, they specify the factors that affect the chain of innovation within an alliance context and group them at the individual, group dynamic and alliance levels.

While their work developed greater insight in what matters in the alliance innovation process and provided a good foundation for guiding managerial attention to the chain of innovation, we still lack a better understanding of how the various factors interact and how those interactions influence innovation within alliances. In this paper, we extend the earlier findings by focusing not only on the impacts of direct and mediated effects but also moderated effects in the innovation process in alliance settings.

Using a dataset of 397 responses on a comprehensive 12-page questionnaire, we empirically test hypothesised effects among selected variables. We present the preliminary findings and clarify additional intricacies of the innovation process in collaborative settings.

EXISTING LITERATURE

Despite the wide range of contributions in the literature that deal with innovation and collaboration, the integration of frameworks addressing the processes and factors that are central to the process of innovation in collaborative arrangements is lacking. There is neither a comprehensive theoretical nor an empirically tested framework guiding researchers in this area. More specifically, there are no studies that present an integrated view of the components of the process of innovation in the alliance context, with the exception of the work done by Bucic and Gudergan (2002). The authors focus on the innovation, creativity, learning and knowledge literature. Aligned with their detailed literature review, we present a brief summary of the main contributions and limitations from the literature.

Innovation

Innovation, particularly through alliances, is recognised as a process crucial for firm development and competitive advantage (e.g., Van de Ven et al, 1979; Clarke and Staunton, 1989; Poole and

DeSanctis, 1990; Edwards, 1999). While the goal of producing a theory of innovation (Downs and Mohr, 1979) has not yet been achieved, various streams of innovation research have converged into a streamlined approach (e.g., Neely and Hii, 1998; Saren, 1984).

The core limitations (as relevant to our research) include the following: throughout the literature, there is no comprehensive model of innovation (Downs and Mohr, 1979; Edwards, 1999); the current literature explains innovation to a large extent but does not provide extensive empirical validation regardless of the unit of analysis – teams, organisations or alliances – (e.g., Neely and Hii, 1998); despite the recognition that cooperative competition (i.e., alliances) can advance innovation (e.g., Von Hippel, 1988) we are still lacking an empirically validated framework at the interfirm unit of analysis (Edwards, 1999).

Creativity

Creativity research has been divided into planned and unplanned processes. With similar dedication, there is much discussion regarding the importance of critical and creative thinking on the process of creativity. This is aligned with Wallas' (1926) suggestion that critical thinking and creative thinking are complementary as these are embedded in a process of constant change. Further, the creativity research discusses the influence of social and contextual surroundings (e.g., Amabile, 1988; Woodman and Schoenfeldt, 1989; Woodman et al., 1993). This latter work identifies the antecedents of creativity at the individual and organisational units of analysis; and the link between creativity and innovation is made explicit (e.g., Amabile, 1988).

Some shortcomings of creativity research include: the link between creativity and innovation is not empirically validated (e.g., Amabile, 1988); the unit of analysis is generally the individual or the organisational levels, that is research is not specific to the alliance unit of analysis; while creativity is identified as a part in the larger domain of innovation, other components affecting innovation are not identified (e.g., Amabile, 1988).

Learning

A focus on the capacity to develop capabilities (e.g., Schendel, 1996) has led to interest in the process of learning. Some of the major contributions to theory development in this field include authors such as Schon (1975), Argyris and Schon (1978) and Kolb (1984). These authors have made contributions at the individual, organisational, and inter-firm levels of learning. Collectively, these authors have suggested that individual learning underlies other units of analysis. Individuals vary in learning styles and thus it is necessary to have a team of individuals to learn together, particularly when developing competencies.

The learning literature also has some limitations. For example, learning is invariably linked to knowledge and there is significant overlap in the literature between these constructs; antecedents for the construct of learning appear to be neglected; there is limited empirical research linking learning to innovation and alliances (e.g., Lane et al., 2001).

Knowledge

A great deal of work has been done in the field of knowledge with significant contributions by Grant (1996) on the knowledge-based view of the firm. The linkage between knowledge stock and innovation, particularly in alliances, has been made explicit in the literature where knowledge is of central importance in the process of innovation (e.g., Kogut, 1988; Hamel et al., 1989). Knowledge is primarily conceptualised as tacit and explicit (e.g., Nonaka and Takeuchi, 1995). As with the learning literature, the knowledge work focuses on the individual as the "producer" of knowledge, but extends this to include the firm as a system providing a culture and systems conducive to knowledge creation, transfer and storage.

The limitation of the knowledge literature include; a lack of a comprehensive and empirically validated theory of knowledge within an organisational context; multiple terms are used interchangeably and confusing interpretations of seemingly identical factors with their contexts; while the link to innovation is explicit, there is the implicit suggestion that knowledge is not the single driver of innovation in general and within the context of alliances.

Summary

We argue that these contributions provide a good foundation for strengthening our understanding of creativity, learning and knowledge. However, despite the identification of these factors as significant for innovation (e.g., Hamel et al., 1989), researchers have largely neglected an integrative approach. The isolated consideration of these fields has resulted in researching separate areas without having an integrative focus taking into account the process of innovation as a specific area of research. Our review of literature concerning creativity, learning and knowledge suggests that these studies provide limited insights into the process of innovation in general, and specifically, at the alliance level.

Addressing these gaps in the literature would contribute to the advancement of innovation research and in turn, the general management and strategy literature. The *Process of Innovation Model* (Bucic and Gudergan, 2002) begins to illustrate the relevance of an integrated approach to these core constructs. Extending the contributions of their existing model, we address the more complex phenomena of interaction effects.

MODEL DEVELOPMENT

In this paper, we use the *Process of Innovation in Alliances* (Bucic and Gudergan, 2002) model (Figure 1) as the foundation for our work. In this model, the core constructs of alliance creativity, alliance learning, alliance knowledge stock and alliance innovation are presented in a "chain of innovation". The creativity, learning and knowledge stock constructs form the *chain of innovation*, which determines innovation within an alliance setting. In this paper, we focus on the same antecedent factors of the chain of innovation. For example, the individual level factors include *intrinsic motivation* and *extrinsic motivation* and *critical thinking*. The group dynamic factors consist of *communicative interaction*, *job autonomy*, and *diversity*. The alliance level

factors comprise of two cultural elements - *risk orientation* and *collectivism*, two structural elements - *centralisation and formality* and of *absorptive capacity*.

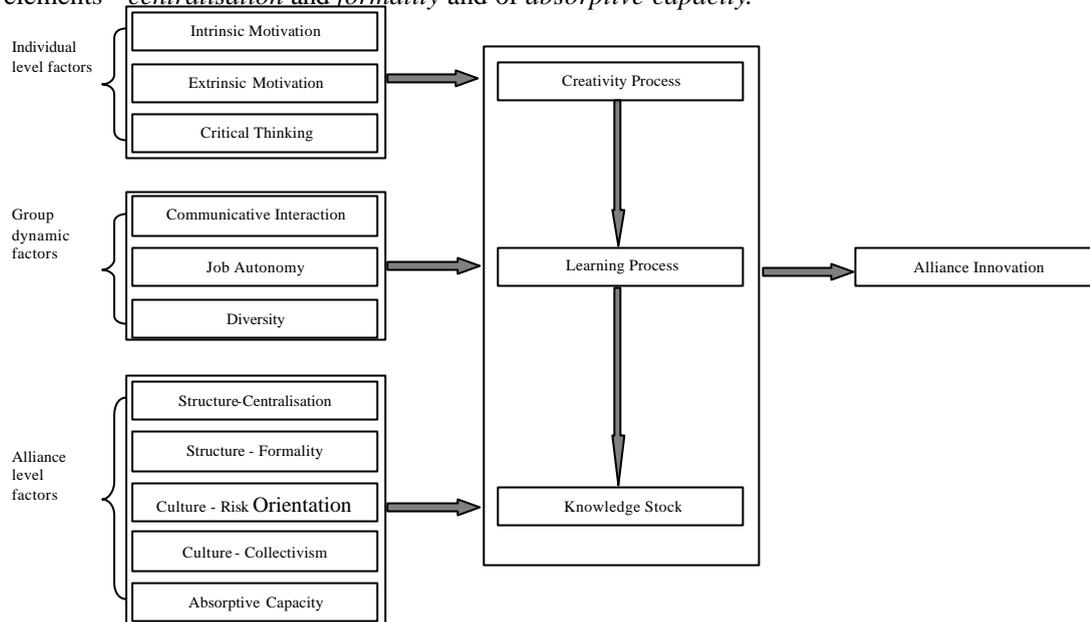


FIGURE 1: THE PROCESS OF INNOVATION IN ALLIANCES MODEL

In addition to addressing the direct and mediated effects of these antecedents, we also examine moderated effects of relevant factors. These include the effect of *communicative interaction* on *alliance learning* and *alliance creativity* being moderated by *diversity*; the effect of *communicative interaction* on *alliance learning* being moderated by *collectivism*; the effect of *alliance learning* on *alliance knowledge stock* being moderated by *absorptive capacity*; and the effect of *alliance knowledge stock* on *alliance innovation* being moderated by *absorptive capacity*. Taking into account these interaction effects extends the original model. The sets of original and new hypotheses are summarised in Appendix 2. The inclusion of moderated effects is the unique contribution of this paper. While we do not derive the direct and mediated relationships which are outlined in the original model (Bucic and Gudergan, 2002), we will now provide an outline providing a rationale for the interaction effects

Communicative interaction derives from Habermas' (1984) communicative rationality concept and refers to group-oriented interaction. Communicative interaction, through shared frames of references and understandings develops informal bonds that uphold communities of practice complementing shared knowledge, learning and change (Wengar and Snyder, 2000; Sawhney and Prandelli, 2000). We define *communicative interaction* as *human interaction is the course of communication*. This perspective views communicative interaction as a collective activity that brings together individuals from groups that can vary in terms of the diversity of its members. Diversity is linked to creativity (e.g., Amabile et al., 1994) and to innovation (e.g., Cox, 1991) as

leading to flexible and superior inputs. Team member diversity leads to knowledge spillovers encouraging individuals with differing skills to collaborate and engage in imaginative use of resources (e.g. Desrochers, 2001). We define *team member diversity* as *the varied composition of the alliance team, comprising individuals of varying backgrounds (e.g., educational and experiential)*.

Collectivism refers to a mindset which is characterised by individuals working towards common objectives (e.g., O'Donnell, 2000). Such common goals stimulate cooperation and commitment (e.g., Collier and Esteban, 1999) and focus team member efforts on common goals (e.g., O'Reilly, 1989). Thus, the focus of collectivism is on the social community (e.g., Sosik and Jung, 2002). We define *cultural collectivism* as *alliance team collegiality that upholds common goals among members, setting a collaborative precedent for information exchange and accumulation*.

From the above explanations it is clear that communicative interaction is a social process that acts as an avenue for information exchange. Accordingly, it is an inevitable part of the socialisation process of team members. In this paper we argue that diversity and collectivism moderate the effects of communicative interaction. That is, the effect of heterogeneous team members on the interaction between group members is dissimilar to the effect of homogeneous team members. Thus, we propose that diversity moderates the effect of communicative interaction on alliance creativity and alliance learning. Similarly, we suggest that collectivism moderates the impact of communicative interaction on alliance learning.

Absorptive capacity refers to the firm's ability to recognise and integrate valuable information into existing systems (e.g., Cohen and Levinthal, 1990). Its role in relation to external knowledge is emphasised by economists (Mangematin and Nesta, 1999) for its influence on the extent to which knowledge is produced, exchanged and used in the selection or rejection of innovations (Ford, 1999). A firm's pre-existing knowledge structure determines its level of absorptive capacity and influences their extent of learning and knowledge production (Tasi, 2001). We define *absorptive capacity* as *the alliance team's ability to recognise and integrate valuable information and knowledge into existing routines to produce new knowledge, or to enhance existing competencies*.

Learning does not necessarily create a visible change in effectiveness or behaviour. Rather, the process of learning causes an increase in understanding that adds to the organisational knowledge base (Huber, 1991). Nohira and Eccles (1992) suggest that inter-organisational links enhance innovative capabilities by providing shared opportunities for learning and knowledge transfer. We define *alliance learning* as *the acquisition of information and ideas that evolve between people in a community*.

Knowledge stock is linked to the creation of capabilities (e.g., Teece et al., 1997) and competencies (e.g., Prahalad and Hamel, 1990). As Cohen and Levinthal (1990) suggest, the level of knowledge stock determines the extent to which a firm is able to adapt to change. We define knowledge stock as *an accumulation of tacit and explicit knowledge from internal and external sources*.

The theoretical underpinnings of the constructs of learning and knowledge suggest that alliance learning and alliance knowledge stock are closely related: learning is the process by which knowledge stock is accumulated. From the perspective of the innovation process, it is imperative to enhance the learning process and to renew knowledge repositories. Absorptive capacity influences the processes of learning and knowledge accumulation in this context. That is, although absorptive capacity is as yet, a poorly understood phenomenon, the literature implies that it is a multidimensional enabler of business malleability and receptivity. Thus, absorptive capacity enhances the relationship between alliance learning and alliance knowledge stock. Similarly, the positive effect between alliance knowledge stock and alliance innovation is strengthened by absorptive capacity.

METHODOLOGY

The setting for this research is in Australia, and includes medium to large sized organisations that are involved in alliances. To reduce the probability of potentially dominant industries skewing results, the sample contains organisations from a range of industries including: banking/finance, tourism, education, government services, transport, communications, IT, construction/building, outsourcing, manufacturing, community, FMCG, professional services, engineering, utility, primary industries.

We used a key informant study due to the foreseen difficulty of collecting relevant responses in a timely fashion. As reported in earlier studies (e.g., Borg and Gall, 1989), key informants provide insights into processes that enable the researcher to understand implications of specific findings. Further, Kumar and co-authors (1993) suggest that key informants are selected because they are knowledgeable about the topic area and are able and willing to communicate this information. For these reasons, we chose to target key informants rather than a set of alliance members as this would have reduced our response rate very significantly.

A pilot study was conducted using face-to-face interviews with selected alliance managers (key informants). This pilot enabled us to confirm the validity of the phenomenon proposed for research, to confirm the appropriateness of the proposed data collection technique, and finally, to review the questionnaire for ambiguity and potential additional inclusions.

For each of the 4,500 potential respondents in our sample, we posted a package including the 12-page questionnaire, cover letter and self addressed reply paid envelope. The packages were addressed to the General Manager, Chief Executive Officer or Managing Director, as specified on the database list. The cover letter explained the purpose of the research and requested that the addressee pass the pack on to the most suitable Alliance Manager or other key informant for completion and return within two weeks of receipt. We provided an incentive comprising a summary report of the findings of the study that would be posted to respondents upon completion of the study.

The survey resulted in 397 useable responses reflecting an effective response rate of 12.53%. This suffices the conditions for structural equation modelling using PLS analysis, which we have carried out to assess the model relationships. To look at the impact of interaction effects within

our model, we first analyse the original model and then the extended model including the interaction effects. By comparing the two, we are able to better understand the additional explanatory power of the interaction effects.

PRELIMINARY FINDINGS & DISCUSSION

The findings for the original model are summarised in Appendix 3. They show that alliance innovation has an R-square of 0.308, indicating that the model is capable of explaining a sufficient level of variances. The constructs of the *alliance creativity*, the *alliance learning* and *alliance knowledge stock* have significant and positive effects on *alliance innovation* confirming our hypothesised relationships (i.e., the *chain of innovation*).

Our analyses show that the factors within this chain of innovation are influenced by a set of antecedents. More specifically, focusing on *alliance creativity* (R-sq 0.517) we found that *job autonomy*, *critical thinking*, *intrinsic motivation*, *communicative interaction*, *risk orientation* and *team diversity* have positive and significant effects of *alliance creativity*. *Structural centralisation* had a significant, but negative effect, while *extrinsic motivation* and *structural formality* had non-significant effects on *alliance creativity*.

Similarly the effects of antecedents on *alliance learning* (R-sq 0.247) were varied. For instance, *intrinsic motivation* and *communicative interaction* were positive and highly significant, while *critical thinking* had a positive but less significant impact. The remaining antecedents comprising *extrinsic motivation*, *team diversity*, *structural centralisation*, *structural formality*, *cultural collectivism* and *alliance creativity* had non-significant effects on *alliance learning*.

For the remaining construct in the innovation chain, *alliance knowledge stock* (R-sq 0.454), we analysed the impact of two factors, *alliance learning* and *absorptive capacity*. *Alliance learning* yielded a positive and significant result. *Absorptive capacity*, however, had a positive but non-significant effect.

While most effects in the original model were as hypothesised, several findings were of particular interest. That is, the effects of *structural formality* and *structural centralisation* at the alliance level yielded results in the following order; *centralisation* negative for both *alliance creativity* and *learning*, but non significant for *alliance learning* and significant for *alliance creativity*. *Structural formality* was positive but non-significant for both *alliance creativity* and *learning*. This suggests that structural aspects (excepting centralisation for creativity) seem to be irrelevant in regards to alliance-level collaborative innovation. These findings are aligned with the current debate amongst management scholars, focusing on the relevance of *formality* and *centralisation* at various organisational levels. Further, it was interesting to note that *extrinsic motivation* was non-significant for both *alliance creativity* and *learning*. Likewise, *cultural collectivism* had a negative and non-significant effect on *alliance learning*. Our findings from the preliminary analysis imply that *extrinsic motivation* and *structural formality* do not drive the *alliance creativity* and *learning processes*. In addition, *team diversity*, *centralisation*, *collectivism* and *creativity* do not function as dominant factors impacting on the *alliance learning process*.

The findings for the extended model including interaction effects (see Appendix 4 for results) show that alliance innovation has an R-square of 0.340. From the outset, based on R-squares this extended model appears to be better in explaining the variance in the final dependent variable than the original model. This model includes all factors looked at in the original model plus additional interaction effects outlined in previous sections.

The results suggest some interesting findings. Within the *chain of innovation*, for example, *alliance creativity* and *learning* both have positive and significant effects on *alliance innovation*, while the effect of *alliance knowledge stock* is positive but non-significant, the interaction effect of *absorptive capacity* and *knowledge stock* has a positive and significant impact.

For *alliance creativity* (R-sq 0.519) antecedent factors comprising *critical thinking*, *intrinsic motivation*, *communicative interaction*, *risk orientation* and *job autonomy* has positive and significant effects. *Structural centralisation* had a negative and significant effect, *extrinsic motivation* and *structural formality*, had non-significant effects on *alliance creativity*. The moderated effect of *communicative interaction* and *team diversity* revealed a positive and significant relationship, providing evidence for the impact of *communicative interaction as moderated by team diversity*. Furthermore, although the effect of *team diversity* (singular construct) was positive, it appeared redundant with inclusion of the interaction effect of *diversity* and *communicative interaction*.

For *alliance learning* (R-sq 0.248) factors having a positive and significant influence include *critical thinking*, *intrinsic motivation* and *communicative interaction*. *Extrinsic motivation*, *diversity*, *structural formality* and *alliance creativity* had positive but non-significant effects on *alliance learning*. *Structural centralisation* and *cultural collectivism* had negative but non-significant effects. The interaction effects of *diversity* and *communicative interaction* and *collectivism* and *communicative interaction* had positive and negative path relationships respectively on *alliance learning*, but were not significant.

The results for *Alliance knowledge stock* (R-sq 0.422) are somewhat different to those in the original model. That is, *alliance learning* remained positive, and *absorptive capacity* has a positive and significant impact. The interaction effect of *absorptive capacity* and *learning* is negative and not significant.

The findings of this extended model complement those discussed in Bucic and Gudergan (2002). For example, *structural formality* is not significant on both *alliance learning* and *creativity*; *structural centralisation* is negative and moderately significant in its impact on *alliance creativity*, but not significant on *alliance learning*; and *extrinsic motivation* is not significant on both *alliance creativity* and *learning*. It is also interesting to note that the interaction effect of *creativity* and *learning* are weak and lacking significance. However, the most curious of the findings is the negative and non-significant impact of the interaction effect of *alliance learning* and *absorptive capacity* on *alliance knowledge stock*. This result is inconsistent with the literature and some prior research.

Our findings suggest that the management debate regarding the relevance of *structural formality*

and *centralisation* is applicable to alliance level research. That is, while structural formality and centralisation are relevant within their respective organisational contexts and levels, they do not have an impact on removed organisational levels. Further, our initial results suggest that many effects on alliance learning and creativity are direct and not moderated. Despite our findings in relation to moderated effects, it is worthwhile to note that the extended model including interaction effects does possess a higher r-square than the original model, implying a greater ability to explain variances. However, further analyses will help to explore the intricacies of the extended model in greater detail.

CONCLUSION

The key-contribution of this study is an empirically tested model that explains the components that drive the process of collaborative innovation, taking into account direct, indirect and interaction effects. It is the latter in particular, which is not only unique within the context of research on collaborative innovation but also strengthens our understanding of the learning, knowledge and innovation aspects within interorganisational relationships.

We acknowledge that our most curious finding - that of the interaction between absorptive capacity and learning on alliance knowledge stock - is highly unusual. Yet, while, at present, both alliance learning and alliance absorptive capacity are not well understood organisational phenomena, we will explore these aspects in greater detail in future research.

Further, we are able to provide additional support for the existence of a chain of innovation within the context of alliances; linking alliance creativity, learning and knowledge stock with alliance innovation. Moreover, factors positively and significantly impacting on creativity include critical thinking, intrinsic motivation, communicative interaction, team diversity, job autonomy and potentially but negatively, structural centralisation. Factors not driving alliance creativity include extrinsic motivation, structural formality and the moderated effect of communicative interaction by team diversity.

Factors positively and significantly driving alliance learning include intrinsic motivation, communicative interaction, critical thinking. Factors that are non-significant for alliance learning include extrinsic motivation, structural formality and centralisation, alliance creativity, the interaction effect of communicative interaction and collectivism and the interaction effect of communicative interaction and team member diversity. Furthermore, factors driving alliance knowledge stock include alliance learning and absorptive capacity.

Overall, this preliminary analysis allows us to group the various factors that are pertinent in the process of innovation in alliances. These include alliance creativity, learning and knowledge, intrinsic motivation, communicative interaction, critical thinking, job autonomy, team diversity, absorptive capacity, structural centralisation and cultural collectivism. The identification of these factors provides a more detailed understanding of collaborative innovation in alliances. This will enable management to focus their efforts in innovation management, resulting in more significant progress in innovation within a collaborative context.

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APPENDIX 1

CONSTRUCT NAMES AND DEFINITIONS :

A COMPONENTIAL MODEL OF THE ALLIANCE INNOVATION PROCESS

CONSTRUCT NAME	CONSTRUCT DEFINITION
Alliance Innovation	A novel solution that is of social or economic value, and is the outcome of a collaborative, dynamic and renewable system
Alliance Creativity	The ongoing establishment of unprecedented thought reflecting integration of variables to generate original ideas and unique solutions in a collaborative context
Alliance Learning	The acquisition of information and ideas that evolve between people in a community of practice
Alliance Knowledge Stock	A collective accumulation of tacit and explicit knowledge from internal and external sources
Individual – Intrinsic Motivation	Individual involvement in an activity for personal interest and satisfaction
Individual - Extrinsic Motivation	Individual involvement in a task to meet external criteria
Individual Critical Thinking	A questioning and investigative approach to problem solving
Team Diversity	The composition of the alliance team, comprising individuals of varying educational and experiential backgrounds
Team Communicative Interaction	Human interaction (formal and informal) in the course of communication
Team Member Job Autonomy	The extent to which team members are able to make independent decisions regarding their own job functions
Team Culture – Risk Orientation	Collective values and beliefs reflecting the risk taking tendencies of the alliance team
Team Culture – Collectivism	Alliance team collegiality that upholds common goals among members, setting a collaborative precedent for information exchange and accumulation
Team Absorptive Capacity	The alliance team's ability to recognise and integrate valuable information and knowledge into existing routines to produce new knowledge, or to enhance existing competencies
Alliance Structure – Centralisation	Overarching governance that instils concentration of decision-making authority within the alliance
Alliance Structure – Formality	Overarching level of hierarchical and formal control defining operating guidelines of the alliance

APPENDIX 2

HYPOTHESES IN THE COMPONENTIAL MODEL OF THE ALLIANCE INNOVATION PROCESS

HYPOTHESES ON ALLIANCE INNOVATION	
H21	The greater the more effective the creativity process the greater the alliance innovation
H22	The greater the effectiveness of learning process the greater the alliance innovation
H23	The greater the knowledge stock the greater the alliance innovation

HYPOTHESES ON ALLIANCE CREATIVITY	
H1	Greater intrinsic motivation has a positive effect on alliance creativity
H2	Greater extrinsic motivation has a negative effect on alliance creativity
H3	Critical thinking has a positive effect on alliance creativity
H4	Job autonomy has a positive effect on alliance creativity
H5	Greater communicative interaction has a positive effect on alliance creative
H6	Alliance team member diversity has a positive effect on alliance creative
H7	The greater an alliance's risk orientation the more effective alliance creativity
H8	Greater structural centralisation has a negative effect on alliance creativity
H9	Greater structural formality has a negative effect on alliance creativity
HYPOTHESES ON ALLIANCE LEARNING	
H10	Greater intrinsic motivation has a positive effect on alliance learning
H11	Greater extrinsic motivation has a positive effect on alliance learning
H12	Critical thinking has a positive effect on alliance learning
H13	Greater communicative interaction has a positive effect on alliance learning
H14	Alliance team member diversity has a positive effect on alliance learning
H15	The greater the cultural collectivism, the greater alliance learning
H16	Greater structural centralisation has a negative effect on alliance learning
H17	Greater structural formality has a negative effect on alliance learning
H18	The more effective the creativity process, the more effective alliance learning
HYPOTHESES ON ALLIANCE KNOWLEDGE STOCK	
H19	Greater alliance absorptive capacity leads to a greater alliance knowledge stock
H20	The greater the effectiveness of learning process the greater the alliance knowledge stock
HYPOTHESES ON INTERACTION EFFECTS	
H24	<i>The positive impact of communicative interaction on alliance learning is strengthened by alliance team member diversity</i>
H25	<i>The positive impact of communicative interaction on alliance creativity is strengthened by alliance team member diversity</i>
H26	<i>The positive impact of communicative interaction on alliance learning is strengthened by alliance team member cultural collectivism</i>
H27	<i>The positive impact of alliance learning on alliance knowledge stock is strengthened by absorptive capacity</i>
H28	<i>The positive impact of alliance knowledge stock on alliance innovation is strengthened by absorptive capacity</i>

APPENDIX 3 (ORIGINAL)

<i>Innovation Rsq=0.308</i>	PATH	T-STAT	SIG LEVEL
Creativity	0.241	3.4953	****
Learning	0.239	3.3517	****
Knowledge	0.168	2.2675	**
ACKnow			
<i>Creativity Rsq=0.517</i>			
Job autonomy	0.09	2.6665	***
Critical thinking	0.239	4.8387	****
Intrinsic motivation	0.201	3.9775	****
Extrinsic motivation	-0.035	-0.8711	ns
Comm Int	0.14	2.2434	**
Diversity	0.117	3.3881	****
Struct - centralisation	-0.084	-2.3091	**
Struct - formality	0.055	0.7813	ns
DiCI			
Risk orientation	0.291	7.1733	****
<i>Learning Rsq=0.247</i>			
Critical thinking	0.196	1.6163	*
Intrinsic motivation	0.185	2.0127	**
Extrinsic motivation	0.057	0.9967	ns
Comm Int	0.185	3.1604	****
Diversity	0.035	0.3955	ns
Struct - centralisation	-0.031	-0.3856	ns
Struct - formality	0.038	0.2509	ns
Cultural collectivism	-0.017	-0.2488	ns
DiCI			
CoCI			
Creativity	0.05	0.6989	ns
<i>Knowledge Rsq=0.454</i>			
Learning	0.624	10.2768	****
Absorptive Capacity	0.094	1.2466	ns
ACLng			

APPENDIX 4 (MODERATED)

<i>Innovation Rsq=0.340</i>	PATH	T-STAT	SIG LEVEL
Creativity	0.165	3.0571	***
Learning	0.229	3.0747	***
Knowledge	0.029	0.4236	ns
ACKnow	0.287	3.6596	****
<i>Creativity Rsq=0.519</i>			
Job autonomy	0.004	2.0522	**
Critical thinking	0.237	5.1224	****
Intrinsic motivation	0.202	4.4174	****
Extrinsic motivation	-0.031	-0.8472	ns
Comm Int	0.127	2.5721	***
Diversity	0.059	0.8012	ns
Struct - centralisation	-0.082	-2.019	**
Struct - formality	0.052	0.828	ns
DiCI	0.075	1.1763	*
Risk orientation	0.288	6.8427	****
<i>Learning Rsq=0.248</i>			
Critical thinking	0.236	3.2588	****
Intrinsic motivation	0.154	2.868	***
Extrinsic motivation	0.202	1.0215	ns
Comm Int	0.201	2.5985	***
Diversity	0.027	0.2495	ns
Struct - centralisation	-0.018	-0.2673	ns
Struct - formality	0.036	0.3225	ns
Cultural collectivism	-0.001	-0.0119	ns
DiCI	0.033	0.3586	ns
CoCI	-0.029	-0.3562	ns
Creativity	0.056	0.7999	ns
<i>Knowledge Rsq=0.427</i>			
Learning	0.72	6.3028	****
Absorptive Capacity	0.28	2.1217	***
ACLng	-0.266	-1.454	*

N.B. T-Statistics for these analyses were derived using Bootstrapping, in Partial Least Squares Analysis.