1st Call for H.F.R.I. Research Projects for the Support of Faculty Members and Researchers and the Procurement of high-cost Research Equipment

Deliverable 6: Tables with the descriptive statistics and the results of the study

Organizational Learning and Performance Outcomes: A Multilevel Longitudinal Study

ORGLEARN

HFRI-FM17-1799

Analyses Overview

Our goal was to fully test the theoretical framework we presented in Deliverable 2 in a single model. However, multilevel analyses involving multiple cross level relationships require very large statistical power and extensive sample sizes (Asparouhov & Muthén, 2018; Peterson, Arregle, & Martin, 2012). While we tried to run the whole model in MPlus 8.7 (Muthén & Muthén, 2017) using all the advance features it provides (e.g., Montecarlo estimator), that was not possible – the model could not be estimated (MPlus input did not converge into results).

Therefore, and to fully utilize the data collected, we run two models based on the conceptual framework developed in Deliverable 2. The first model (Model 1) involved all the hypotheses at the team level of analysis (see the red box in Figure 1). The second one (Model 2) involved the multilevel hypotheses (i.e., 5a and 5b) (see the black box in Figure 1).

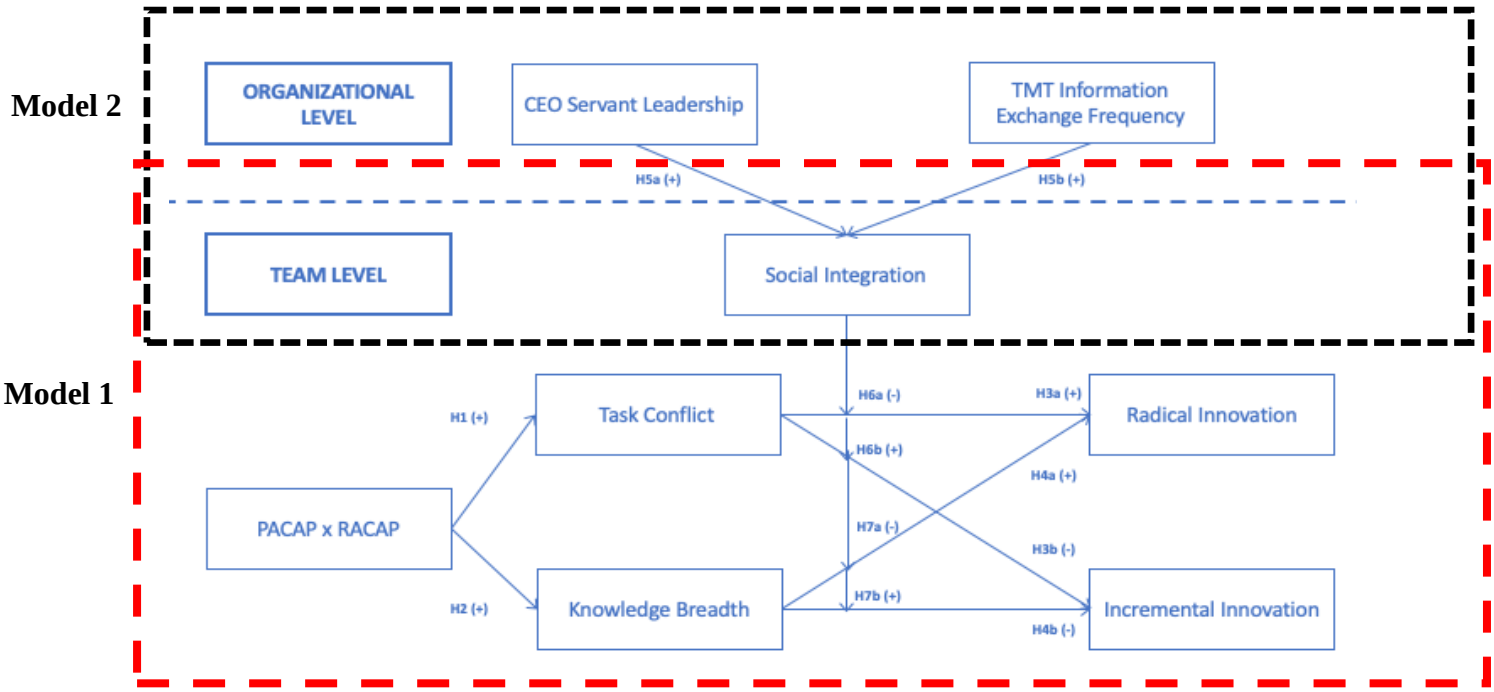


Figure 1: *The Conceptual Framework of Organizational Learning based on Deliverable 2*

In line with the conceptual model developed in Deliverable 2, our hypotheses read:

Hypothesis 1: The interaction between an NPD team's potential and realized absorptive capacity is positively related to task conflict.

Hypothesis 2: The interaction between an NPD team's potential and realized absorptive capacity is positively related to knowledge breadth.

Hypothesis 3: Task conflict is (a) positively related to radical innovation and (b) negatively related to incremental innovation within NPD teams.

Hypothesis 4: Knowledge breadth is (a) positively related to radical innovation and (b) negatively related to incremental innovation within NPD teams.

Hypothesis 5: (a) CEO servant leadership and (b) TMT information exchange frequency are positively related to a NPD team's social integration.

Hypothesis 6: Team social integration moderates the relationship between (a) task conflict and radical innovation in such a way that this positive effect is weaker when social integration is high within NPD teams (b) task conflict and incremental innovation in such a way that this negative effect is weaker when social integration is high within NPD teams.

Hypothesis 7: Team social integration moderates the relationship between (a) knowledge breadth and radical innovation in such a way that this positive effect is weaker when social integration is high within NPD teams (b) knowledge breadth and incremental innovation in such a way that this negative effect is weaker when social integration is high within NPD teams.

Model 1 - Descriptive Statistics

Table 1: *Means, standard deviations, and correlations*

Variables	Mean	*SD*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1. Radical Innovation	5.01	1.47	-														
2. Incremental Innovation	4.69	1.79	.32**	-													
3. PACAP	5.61	0.92	.22*	.24**	-												
4. RACAP	5.60	0.76	.25**	.32**	.49**	-											
5. Task Conflict	4.20	1.04	.15	-.26**	-.04	-.09	-										
6. Knowledge Breadth	4.64	1.25	.31**	-.19*	.16	.10	.21*	-									
7. Social Integration	5.98	0.88	.24**	.29**	.07	.00	-.25**	-.04	-								
8. Team Size (Log)	0.89	0.20	.03	.09	-.01	.08	-.07	.09	.00	-							
9. Team Educational Diversity	0.44	0.26	-.06	.08	-.03	-.08	-.04	-.08	.08	.14	-						
10. Team Functional Diversity	0.38	0.28	-.07	.08	.03	-.02	.00	-.06	.03	.28**	.41**	-					
11. Project Duration (Log)	1.13	0.15	.08	.15	.12	.18*	-.12	-.10	.00	.14	.13	-.14	-				
12. Project Type	0.58	0.49	.21*	.16	.10	.05	.06	.12	.03	.10	.00	.07	.02	-			
13. Gender[a]	0.51	0.50	.00	-.06	.03	-.08	.19*	.00	-.15	-.09	.08	.01	-.14	-.02	-		
14. Age[a]	41.86	9.28	-.08	-.12	-.02	.04	-.04	.08	-.15	-.09	.12	.09	-.12	.06	.07	-	
15. Firm Tenure[a]	9.35	6.06	.02	.02	-.07	.04	.07	.01	.00	-.12	-.06	.00	-.08	-.03	.00	.27**	-

Notes: Team-level N=125.
* $p < 0.05$, ** $p < 0.01$.
[a]Manager's demographics.

Measures

Incremental Innovation. We used an existing scale (adopted from Subramaniam & Youndt, 2005; West & Anderson, 1996) to assess a team's incremental innovations. Specifically, we asked team managers to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree): "This team implemented small improvements to existing products/services", "This team developed products/services that target at existing customers and markets", and "This team introduced products/services that reinforce the existing portfolio of products and services".

Radical Innovation. We used an existing scale (adopted from Subramaniam & Youndt, 2005; West & Anderson, 1996) to assess a team's radical innovations. Specifically, we asked team managers to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree): "This team introduced completely new products/services", "This team developed products/services that open up new markets", and "This team introduced fundamental changes to current products/services".

Potential Absorptive Capacity (PACAP). Previous research has associated PACAP with knowledge acquisition and knowledge assimilation. Specifically, we adapted a existing scales from Jansen, Van Den Bosch, and Volberda (2005) for each dimension and asked team members to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree). Knowledge acquisition: "Our team regularly collected new information from external sources", "Our team systematically interacted with customers or external parties to acquire new knowledge", and "We periodically organized special meetings with people external to the team to acquire new knowledge". Knowledge assimilation: "We systematically analyzed and interpreted new information obtained from sources external to the team, "New information regarding our team was quickly understood", and "Our team quickly reached consensus (shared opinion) regarding new requirements and shifts in our project".

Realized Absorptive Capacity (RACAP). Previous research has associated RACAP with knowledge transformation and knowledge exploitation. Specifically, we adapted existing scales from Jansen et al. (2005) and asked team members to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree). Knowledge transformation: "Our team was able to recognize the usefulness of new external knowledge for existing knowledge", "We regularly combined new knowledge with existing knowledge during team activities", and "In our team, we regularly discussed the consequences and implications of new external knowledge to existing knowledge and skills". Knowledge exploitation: "We systematically incorporated new knowledge into team operations", "Our team utilized new knowledge to refine current (or develop new) skills and practices", and "In our team, we constantly considered how to better exploit knowledge".

Task Conflict. We used an existing scale from the study of Jehn and Mannix (2001) to assess a team's task conflict. Specifically, we asked team members to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree): "There was conflict of ideas in our team", "There were frequent disagreements within the team about the tasks of the project we were working on", and "Team members had conflicting opinions about the group tasks".

Knowledge Breadth. We used an existing scale from Bierly and Chakrabarti (1996) to assess a team's knowledge breadth. Specifically, we asked team members to respond to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree): "Our team built a broad range of knowledge about this project domain", "We gained diverse expertise in this project domain", "Our team became familiar with a variety of information in this project domain".

Social Integration. We used an existing scale from O'Reilly, Caldwell, and Barnett (1989) to assess a team's social integration. Specifically, we asked team members to respond

to the following questions on a scale ranging from 1 (totally disagree) to 7 (fully agree): "The members of this team were quick to defend each other from criticism by outsiders", "Team members really stuck together", "Everyone's input was incorporated into most important team decisions", "It was common for team members to be satisfied with the final decisions made by the team", "Relationships between team members could be best described as "win-win" (achieved mutually acceptable compromises)".

Control Variables. We controlled for *team size* as the logarithm of the number of team members because larger teams may have more resources and opportunities to leverage their absorptive capacity (Ancona & Caldwell, 1992). Additionally, we controlled for *team educational diversity* by asking team members to report their most recent degree. Based on their responses, these degrees were grouped into eight categories (e.g., pharmacy, mathematics, engineering, business). To calculate educational diversity, we used Blau's formula (1977) $1 - \Sigma pi^2$, where p represented the proportion of team members in the ith (i.e., degree) category. Similarly, and to control for *team functional diversity*, we asked team members to choose their background from six functional areas (Research & Development, production, IT, sales and marketing, finance and accounting, human resources, and other) and then used Blau's formula (1977) to calculate the score for each team. Furthermore, we controlled for more general team-level characteristics such as the logarithm of project duration, and project type (service = 0; product = 1). Lastly, we controlled for manager's characteristics (i.e., *Gender*, *Age*, and *Firm tenure*) since it's the one who rated our dependent variables.

Results

We conducted hierarchical linear modeling in SPSS 28 to test our hypothesized relationships. In Table 1, all bivariate correlations are below the commonly used threshold of 0.60, thereby mitigating concerns about multicollinearity. We further calculated the variance inflation factors (VIFs) for each coefficient, all of which were substantially below the most

commonly used cut-off value of 10 (Neter, Wasserman, & Kutner, 1990), providing further evidence that multicollinearity was not an issue in our analyses.

To test hypotheses 1 and 2 we regressed the interaction between an NPD team's potential and realized absorptive (PACAP*RACAP) to team's task conflict and knowledge breath. As the results in Table 2 indicate, team's PACAP*RACAP is positively related to both task conflict (b=.28, p<0.01) and knowledge breadth (b=.39, p<0.01), hence, confirming Hypotheses 1 and 2.

Furthermore, to test all the remaining team-level hypotheses, we first entered the controls in the model, we then added the direct effects of task conflict, knowledge breath and social integration, and at the end the interaction terms to team's incremental and radical innovation. The results presented in Table 2, show that task conflict is positively related to radical innovation (b=.29, p<0.05) and negatively related to incremental innovation (b= -.33, p<0.05), confirming Hypotheses 3a and 3b. Additionally, knowledge breadth is positively related to radical innovation (b=.32, p<0.001) and, marginally, negatively related to incremental innovation (b=-.22, p<0.10), confirming Hypotheses 4a and 4b. In terms of our moderating hypotheses, the interaction between team's task conflict and social integration is not related to team's radical innovation (b=.12, *n.s.*), and is marginally positively related to team's incremental innovation (b=.28, p<0.10), thus, rejecting Hypotheses 6a and 6b. Lastly, the interaction between team's knowledge breadth and social integration is negatively related to team's radical innovation (b= -.33, p<0.01), and is not related to team's incremental innovation (b=.02, *n.s.*), thus, confirming Hypotheses 7a and rejecting Hypothesis 7b.

Table 2: *Model 1 Results*

Independent Variables	Dependent Variable			
	Task Conflict	**Knowledge Breadth**	**Radical Innovation**	**Incremental Innovation**
Team Size (Log)	-.28	.94	-.12	.27
	(.49)	(.58)	(.63)	(.80)
Team Educational Diversity	-.19	-.33	-.31	.17
	(.39)	(.47)	(.50)	(.64)
Team Functional Diversity	.13	-.47	-.01	.35
	(.37)	(.45)	(.48)	(.61)
Project Duration (Log)	-.41	-.71	1.37	1.25
	(.63)	(.76)	(.81)	(1.04)
Project Type	.11	.18	.36	.70*
	(.19)	(.22)	(.24)	(.31)
Gender	.37*	-.02	.15	.17
	(.18)	(.22)	(.24)	(.31)
Age	-.01	.01	.00	-.01
	(.01)	(.01)	(.01)	(.01)
Firm Tenure	.01	.00	.00	.02
	(.01)	(.01)	(.02)	(.02)
PACAP*RACAP	.28**	.39**		
	(.11)	(.13)		
Task Conflict			.29*	-.33*
			(.12)	(.16)
Knowledge Breadth			.32***	-.22^{+}
			(.09)	(.12)
Social Integration			.64***	.32
			(.16)	(.21)
Social Integration*Task Conflict			.12	.28^{+}
			(.12)	(.16)
Social Integration* Knowledge Breadth			-.33**	.02
			(.11)	(.14)

N=125 Teams. Unstandardized regression coefficients are reported. Standard errors in parentheses.
$^{+}$p< .10. *p< .05. ** p< .01. *** p< .001.

Model 2 – Results

Measures

Social Integration. We used the aforementioned scale from O'Reilly et al. (1989) to assess a team's social integration.

CEO servant leadership. We used 15-items adopted from an existing scale of Liden, Wayne, Zhao, and Henderson (2008) to assess Chief Executive Officer's (CEO) servant leadership (rated by team manager) on a scale ranging from 1 (totally disagree) to 7 (fully agree). Sample items included (for the full list of items please see Deliverable 4): "To which extent does the CEO of your firm:

(1)...care about your personal well-being.

(2)...take time to talk to you on a personal level.

(3)...give you the responsibility to make important decisions about your job.".

TMT information exchange frequency. We used an existing scale from the study of Ling and Kellermanns (2010) to assess Top Management Team's (TMT) information exchange frequency. Specifically, we asked team managers to respond to the following questions on a scale ranging from 1 to 7: "To which extent do you...

(1)…have face-to-face meetings with the members of your Top Management Team frequently.

(2) ...have written communication (e.g. reports, email, personal notes, etc.) with the members of your Top Management Team frequently.

(3) ...have telephone conversations with the members of your Top Management Team frequently.".

Control Variables. Similar to our previous analysis, at the team-level of analysis, we controlled for *team size*, *team educational diversity*, *team functional diversity, project duration*, and *project type.* At the firm-level of analysis, we also controlled for the *country* of operations,

by including four dummies in our analysis for the five countries represented in our sample (i.e., Switzerland, United Kingdom, Italy, Greece, and Poland). Lastly, we included a dummy variable indicating the primary *sector* in which each firm belongs to (i.e., 0=pharmaceuticals, 1=Information Communication Technology).

Results

We conducted multilevel modeling using Mplus (Muthén & Muthén, 2017) to assess top-down effects (i.e., CEO and TMT characteristics to team social integration). Table 3 presents descriptive statistics and the correlations between study variables. It is interesting that both CEO Servant Leadership and TMT Information Exchange Frequency are strongly correlated with team social integration.

Hypothesis 5 examined the direct top-down effect of CEO Servant Leadership (H5a) and TMT Information Exchange Frequency (H5b) on team Social Integration. As the results of Table 4 indicate, there is a strong and positive relationship of both CEO Servant Leadership (b=.33, p<0.01), and TMT Information Exchange Frequency (b=.26, p<0.01) on team Social Integration. Hence, our Hypotheses 5a and 5b are confirmed.

Model 2 - Descriptive Statistics

Table 3: *Means, standard deviations, and correlations*

Variables	Mean	*SD*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Social Integration	5.98	0.88	-												
2. CEO Servant Leadership	5.78	0.68	.35**	-											
3. TMT Information Exchange Frequency	5.09	0.83	.33**	.25*	-										
4. Sector	0.56	0.49	-.11	-.08	.00	-									
5. Country Dummy 1	0.20	0.40	-.03	-.03	.00	.45**	-								
6. Country Dummy 2	0.14	0.35	.10	-.01	-.10	-.12	-.21	-							
7. Country Dummy 3	0.27	0.44	-.08	-.14	.15	-.02	-.31**	-.25*	-						
8. Country Dummy 4	0.28	0.45	.01	.22*	-.17	-.33**	-.32**	-.26*	-.38**	-					
9. Team Size (Log)	0.89	0.20	.02	-.09	.01	.00	.22*	.06	-.25*	.15	-				
10. Team Educational Diversity	0.44	0.26	.16	-.02	-.04	-.01	.08	.15	-.16	.08	.28*	-			
11. Team Functional Diversity	0.38	0.28	.00	-.25*	-.01	.01	-.04	.00	-.06	.09	.44**	.42**	-		
12. Project Duration (Log)	1.13	0.15	.05	-.05	-.09	-.12	-.09	.11	.12	.06	.14	.09	-.12	-	
13. Project Type	0.58	0.49	-.05	-.01	-.11	-.43**	-.28*	.19	-.06	.25*	.25*	.19	.26*	.11	-

Notes: Team-level N=81.
* $p < 0.05$, ** $p < 0.01$.

Table 4: *Model 2 Results*

	Dependent Variable
Independent Variables	**Team Social Integration**
Sector	-.08
	(.12)
Country Dummy 1	-.16
	(.27)
Country Dummy 2	.13
	(.20)
Country Dummy 3	-.22
	(.20)
Country Dummy 4	-.07
	(.24)
Team Size (Log)	-.18
	(.34)
Team Educational Diversity	.25
	(.34)
Team Functional Diversity	.018
	(.35)
Project Duration (Log)	.07
	(.39)
Project Type	-.01
	(.14)
CEO Servant Leadership	.33**
	(.13)
TMT Information Exchange Frequency	.26**
	(.08)

N=81 Firms. Unstandardized regression coefficients are reported. Standard errors in parentheses.
** p< .01. *** p< .001.

Overview of Results of Models 1 and 2

Hypothesized Relationships	Coefficients	Result
PACAP x RACAP on Task Conflict and Knowledge Breadth		
H_1 (+): PACAP x RACAP → Task Conflict	.28**	*Confirmed*
H_2 (+): PACAP x RACAP → Knowledge Breadth	.39**	*Confirmed*
Task Conflict and Knowledge Breadth on Innovation		
H_{3a} (+): Task Conflict → Radical Innovation	.29*	*Confirmed*
H_{3b} (-): Task Conflict → Incremental Innovation	-.33*	*Confirmed*
H_{4a} (+): Knowledge Breadth → Radical Innovation	.32***	*Confirmed*
H_{4b} (-): Knowledge Breadth → Incremental Innovation	-.22+	*Marginally Confirmed*
CEO Servant Leadership and TMT Information Exchange Frequency on Team Social Integration		
H_{5a} (+): CEO Servant Leadership → Social Integration	.33**	*Confirmed*
H_{5b} (+): TMT Information Exchange Frequency → Social Integration	.26**	*Confirmed*
Moderation of Social Integration		
H_{6a} (-): Task Conflict x Social Integration → Radical Innovation	.12 (*n.s.*)	*Rejected*
H_{6b} (-): Task Conflict x Social Integration → Incremental Innovation	.28+	*Marginal Reverse Effects*
H_{7a} (-): Knowledge Breadth x Social Integration → Radical Innovation	-.33**	*Confirmed*
H_{7b} (-): Knowledge Breadth x Social Integration → Incremental Innovation	.02 (*n.s.*)	*Rejected*

** p< .01. *** p< .001.

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