

# Social Networks in Innovation: The Role of Personality

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## Abstract

Relationships among people at work are important for innovation. We hypothesize that close relationships among people at work (strong network ties) and personality enhance innovation and that personality moderates the effect of network tie strength. Data from 115 engineers in a manufacturing company and university science researchers were used to examine these relationships. Our results show that strong network ties and personality have direct positive effects on innovation while personality does not moderate the effect of network tie strength. In our discussion we elucidate how the findings provide new insights on innovation.

**Keywords:** Networks, network ties, innovation, job performance, personality

## Introduction

Innovation is critical for organizational performance and success [1]. Innovation, the generation and implementation of novel and useful ideas [2], offers solutions to problems and potential for creation and maintenance of competitive advantage; particularly in fast cycle industries. Because of its' importance to organizational performance, innovation has drawn the attention of researchers. Research on innovation has traditionally examined innovation as a firm-level construct; whereas researchers have recently begun to examine individual-level factors influencing innovation as innovation has become a measure of employee job performance at the individual-level in many organizations. This new direction in innovation research includes the effect employees' network at work has on innovation [1, 3].

Network theory argues that networks among people influence performance, the outcome of behavior [4, 5]. Research on social networks in innovation research is rooted on two main aspects: One, innovation is based on a person's acquisition and use of knowledge [6]. Two, a network constitutes a major source of information for the individual [7]. Therefore, networks are critical for innovation at the individual level [1]. Yet, the same factors that facilitate the generation of novel ideas often impede their implementation, limiting their usefulness in innovation [8].

One factor that may enhance or impede innovation is the nature of the relationships in a network, the network ties [9]. Researchers have paid less attention to important factors affecting these network ties [10]. The strength of network ties reflects the connectivity, or closeness, between a person and the other people in the person's network [9]. It also indicates that a person's access to information holds potential to influence an employee's innovation

performance [4]. A factor that may affect the strength of a network tie and innovation performance is personality.

Personality, a person's behavioral traits, trends, and patterns [11], predicts behavior and, in turn, performance [5, 12, 13]. Recent research shows that personality is associated with a person's network, in particular the strength of network ties [14]. Personality has also been found to influence innovation directly [15]. Yet, the moderating effect of personality on the effect of network tie strength on innovation has eluded researchers' attention. Hence the purpose of this study is to examine the effects of the strength of network ties and personality on innovation performance, and to examine the moderating effect of personality on the relationship between the strength of network ties and innovation performance.

### **Hypothesis Development**

Innovation performance—the creation and implementation of novel and useful ideas [16]—for the individual employee depends, in many aspects, on the employee's network within the organization [9, 17, 13] and the employee's personality [2, 18]. Information is a necessary resource for an employee's innovation performance [19]. And, information that an employee does not currently hold may be obtained from the employee's network within an organization [4, 20]; especially from strong network ties, people the employee trusts and has close and frequent interactions with at work [9]. This means the strength of network ties hold potential to positively facilitate the employee's innovation performance [1, 18].

*H1: The strength of network ties is positively associated with innovation performance.*

Personality—the general patterns of people's behavior, thoughts, and feelings [11]—is predictive of behavior and, in turn, performance (5, 12, 13). Specifically, personality has been found to influence job performance [12] such as innovation performance [15]. Hence, we hypothesize that personality is associated with innovation performance. Yet, not all personality traits and factors are equally relevant in all contexts.

In the context of work, conscientiousness seems particularly relevant. Research shows that conscientiousness is the personality factor that predicts job performance best [12]. A conscientious employee desires to do tasks well. The conscientious employee may also be characterized as dependable, efficient, organized, self-disciplined, and achievement oriented [21]. Also in the context of an employee's innovation performance, the personality factor of extroversion seems relevant. This is because the extrovert person tends to be sociable, outgoing and gregarious, talkative, assertive, and energetic, or full of life and positivity [21]—all desirable traits in the context of seeking to develop, revise, promote, and implement novel and useful ideas.

*H2: Conscientiousness is positively associated with innovation performance.*

*H3: Extraversion is positively associated with innovation performance.*

Drawing from adaption–innovation theory, Kirton [18] argues that personality stimulates network building in the workplace and, in turn, employees’ innovation performance. More recently, researchers examined personality in the context of networks to find that personality affects the person’s network, especially the strength of the network ties [14]. As personality temporally exists prior to organizational employment and the development of a personal network within an organization<sup>1</sup> means that personality may be expected to moderate the effect networks have on employees’ innovation performance.

*H4: The relationship between network ties and innovation performance is moderated by conscientiousness.*

*H5: The relationship between network ties and innovation performance is moderated by extraversion.*

## Methods

### Sample and Data Collection

Data to test the hypotheses were collected using a questionnaire in Thai at two locations. We sent 200 questionnaires to engineers in a manufacturing company that produces motorcycle components in Thailand of which 62 useful questionnaires were returned, a response rate of 31 percent. We also sent 200 questionnaires to researchers at a faculty of science of at a large university in Thailand. Fifty-three useful questionnaires were returned from the science faculty resulting in a response rate of 27 percent. This means the total sample for our study was 115 respondents. Among these 115 respondents, 57 respondents (50 percent) held a four-year bachelor degree and 40 respondents (35 percent) were between 31-45 years of age.

### Measures

The dependent variable, innovation performance, was measured using a four-item measure [1]. This measure assesses both idea creation and idea implementation. One of the items states “I find obtain working to ways to implement new ideas.” In this study, alpha was .735 [23].

The independent variable, strength of networks ties, was measured using a five-item scale [22]. One of the five items assessing the strength of network ties states: “There is high reciprocity among members” The alpha was .839 in this study [23].

The personality variables, conscientiousness and extraversion, were assessed using a scales [24]. Conscientiousness was assessed by five items. One item assessing conscientiousness states: “I am a productive person who always gets the job done.” In this study, alpha for conscientiousness measure was .730 [23]. The assessment of extraversion was based on four items of which one of the items states: “I feel comfortable around people.” Alpha for extraversion measure was .777 in this study [23].

All measures were assessed using a five-point scale Likert-type response scale (1= "strongly disagree," 5 = "strongly agree").

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<sup>1</sup> It should be observed that personality is developed, in part, through interaction with other people in various contexts and in isolation in various contexts, and that personality is largely fixed around the age of 30 [25].

## Results

Table 1 shows the means, standard deviations, and correlations. All the correlations are large, positive, and significant [26]. The means are at the response score of 4 meaning the respondents, on average, agreed with the item statements for each measure. The correlations show that the strength of network ties has a strong positive and significant effect on innovation performance ( $r_{NTS-IP} = .55, p \leq .00001$ ) providing support for hypothesis one that states that network ties is positively associated with innovation performance. They also show that conscientiousness had a strong positive significant relationship with innovation performance ( $r_{C-IP} = .60, p \leq .00001$ ) providing support for hypothesis two that conscientiousness is positively related to innovation performance. Hypothesis three stating that extraversion is positively associated with innovation performance is also supported as the correlation shows that extraversion had a strong, positive and significant effect on innovation performance ( $r_{E-IP} = .67, p \leq .00001$ ). Lastly, the correlations also show that personality has a strong effect on the strength of the network ties ( $r_{C-NT} = .60, p \leq .00001$ ;  $r_{E-NT} = .69, p \leq .00001$ ).

Table 1: Means, Standard Deviations, and Correlations<sup>1</sup>

	<b>M</b>	<b>s.d.</b>	<b>1</b>	<b>2</b>
<b>1 Innovation Performance</b>	4.01	.64		
<b>2 Network Tie Strength</b>	4.03	.60	.55*****	
<b>3 Conscientiousness</b>	4.08	.48	.60*****	.60*****
<b>4 Extraversion</b>	3.95	.61	.67*****	.69*****

<sup>1</sup> one-tailed correlations; n = 115; \*\*\*\*\*  $p \leq .00001$

Table 2 shows the regression results on innovation performance<sup>2</sup>. The results for Model 1 show that the strength of network ties has a significant positive effect on innovation performance ( $\beta_{NTS} = .546, p \leq .001$ ) and strength of network ties accounted for 29.8 percent variance in innovation performance ( $F = 48.076; p \leq .001$ ). These results provide additional support for hypothesis one stating that the strength of network ties is positively associated with innovation performance. Hypothesis two stating that conscientiousness is positively related with innovation performance is also supported by the results in Model 2 ( $\beta_C = .601, p \leq .001$ ;  $R^2 = .361, p \leq .001$ ;  $F = 63.815, p \leq .001$ ). The results shown in Model 3 provide additional support for hypothesis three stating that extraversion is positively linked to innovation performance ( $\beta_E = .666, p \leq .001$ ;  $R^2 = .443, p \leq .001$ ;  $F = 90.009, p \leq .001$ ). Going beyond hypothesis testing, results not reported in Table 2 show that when the two personality variables were entered as a single step after network tie strength, personality (that is conscientiousness and extraversion in combination) renders the regression coefficient for network tie strength not significant and personality explains 19.3 percent variance in innovation performance ( $\beta_{NTS} = .102, n.s.$ ;  $\beta_C = .254, p \leq .01$ ;  $\beta_E = .425, p \leq .0001$ ;  $\Delta R^2 = .193, p \leq .0001$ ;  $F = 35.708, p \leq .0001$ ).

To test the moderated relationships in hypotheses 4 and 5 the procedure suggested by Cohen, Cohen, West, and Aiken [27] was followed. The results in Model 4 show that the both network tie strength and conscientiousness are positively associated with innovation performance

<sup>2</sup> No control variables were included for two reasons: (1) the limited number of cases in the sample and (2) methodologists argue against the use of control variable because the variance controlled for is limited to the control variables that may or may not be conceptually relevant and other factors that may be important but are not controlled for are omitted (for more details, please see the work by Schjoedt & Bird, [28]).

( $\beta_{NTS} = .292, p \leq .01$ ;  $\beta_C = .427, p \leq .001$ ;  $F = 39.824, p \leq .001$ ), and the inclusion of conscientiousness explains an additional 11.7 percent ( $p \leq .001$ ) variance in innovation performance. As the results for Model 5 show the addition of the interaction between

Table 2: Results for Regression on Innovation Performance<sup>1,2</sup>

Model	1	2	3	4	5	6	7
NTS	.546***			.292**	.366	.166*	.241
C		.601***		.427***	.488		
E			.666***			.551***	.629*
NTS*C					-.123		
NTS*E							-.142
R <sup>2</sup>	.298***	.361***	.443***	.416	.416	.458	.458
$\Delta R^2$				.117***	.000	.159***	.000
F	48.076***	63.815***	90.009***	39.824***	26.332***	47.306***	31.295***

<sup>1</sup>  $\beta$  is reported; <sup>2</sup> one-tailed significance ;n = 115; NTS: Network tie strength; C: Conscientiousness; E: Extraversion; NT\*C: interaction between network ties and conscientiousness; NT\*E: Interaction between network ties and extraversion;

\*  $p \leq .05$ ; \*\*  $p \leq .01$ ; \*\*\*  $p \leq .001$

network tie strength and conscientiousness does not generate a significant regression coefficient for the interaction, nor does the interaction add any explained variance ( $\beta_{NTS} = .366, n.s.$ ;  $\beta_C = .488, n.s.$ ;  $\beta_{NTS*C} = -.123, n.s.$ ;  $\Delta R^2 = .000, n.s.$ ;  $F = 26.332, p \leq .001$ ), the results do not support hypothesis four stating that conscientiousness moderates the effect of network ties on innovation performance. The results do show that network tie strength and conscientiousness independently influence innovation performance. Furthermore, hypothesis five is not supported because the inclusion of the interaction between network tie strength and extraversion in Model 7 does not provide a significant regression coefficient or explain additional variance in innovation performance ( $\beta_{NTS} = .241, n.s.$ ;  $\beta_E = .629, p \leq .05$ ;  $\beta_{NTS*E} = -.142, n.s.$ ;  $\Delta R^2 = .000, n.s.$ ;  $F = 31.295, p \leq .001$ ) relative to Model 6 ( $\beta_{NTS} = .166, p \leq .05$ ;  $\beta_E = .551, p \leq .001$ ;  $R^2 = .458, p \leq .0001$ ;  $F = 47.306, p \leq .001$ ). The results for Model 6 show that extraversion is a significant factor and inclusion of extraversion explains an additional amount of 15.9 percent ( $p \leq .001$ ) variance in innovation performance.

Because the results in Table 1 show that personality, i.e. conscientiousness and extraversion, have strong effects on the strength of network ties, an additional regression analysis was conducted to assess the impact of personality on network tie strength. This regression analysis showed that personality is a significant factor that accounts for 50.8 percent ( $p \leq .00001$ ) of the variance in network tie strength ( $\beta_C = .244, p \leq .01$ ;  $\beta_E = .525, p \leq .001$ ;  $F = 57.718, p \leq .00001$ ).

## Discussion

The purpose of this study was to examine the relationships among the strength of network ties, personality, and innovation performance, and if personality moderated the effect of network tie strength on innovation performance. We found network tie strength to have a positive direct effect on employees' innovation performance and personality, in the form of conscientiousness extraversion. We also found conscientiousness extraversion, individually and in combination, to have a direct positive effect on innovation performance. We did not find either conscientiousness or extraversion to moderate the effect of the strength of network ties has on employees' innovation performance.

Our findings advance the on-going conversation on the relationship between networks and performance in the workplace. Our findings provide further support for the importance of networks in employees' work and work performance [4, 9]. Our findings are consistent with previous research showing that the strength of network ties is critical in facilitating innovation. Lai, Lui, and Tsang [29] note that the relationships among employees—network ties—positively enhance knowledge sharing that, in turn, facilitate innovation. Further, Rodan and Galunic [30] observe that employees' networks offer access to heterogeneous knowledge that is important for innovation performance. Lastly, Sosa [31] found that strong network ties were effective in idea generation when employees are intrinsically motivated to work closely together. These studies combined with our findings show that the strength of network ties plays a critical role in employees' innovation performance, i.e., work performance. Placing these considerations in a practical context suggests that rich communication in terms of frequency and content among employees, who are trust each other, positively enhances the development, revision, and implementation of new and useful ideas; innovation. More generally, trusted and rich relationships at work provide access to critical informational resources, e.g., feedback and knowledge, which, in turn, enhances employee performance.

Although we did not specifically develop hypotheses regarding the influence personality has on the strength of network ties, we did find that personality, in the forms of conscientiousness and extraversion, has a strong effect on the strength of network ties. This provides further support for existing research that shows employees high conscientiousness have strategies to develop their network to reach people who will be information sources to facilitate the employee's work performance [32]. Previous research also found that extraversion influence the strength of employees' network ties [33]. This is consistent with the results from our additional analyses that show that extraversion has a strong effect on network tie strength and this effect is stronger than that of conscientiousness. This may not be surprising as extrovert people tend to be sociable, outgoing and gregarious, talkative, and full of life [21]; traits that enhance communication.

Our findings support existing research on the impact of personality on job performance, which is innovation performance in our study (12, 15, 18]. Similar to previous research on the influence of personality on innovation (e.g., 15), our findings also contradict some research. Yesil and Sozbilir [34] found that only one personality factor, openness to experience, is associated with innovation behavior. That these researchers found openness to experience associated with innovation behaviors appears reasonable given the traits inherent in the personality factor includes being creative, curious, and adventurous, constantly looking to experience new things, and problem-solving by thinking outside the box [21]. People high on openness to experience dislike routines and are constantly looking to experience new things. These latter traits appear to run contrary to employees working with innovation on a routine basis like engineers and scientists.

One difference between the findings by Yesil and Sozbilir [34] and our findings may be found in the study by Yesil and Sozbilir [34] was based on a sample of hotel employees; employees who are not expected to engage in innovation as a primary aspect of their work whereas that is one of the main work functions for our sample of engineers and scientists. Thus, the nature of the samples, especially the nature of their work, may explain the differences in the findings between the two studies. This indicates additional research with samples from multiple contexts may prove fruitful. Another difference between the two studies is that Yesil and Sozbilir [34] examined innovation behavior whereas we examined innovation performance. As observed

by Brid et al. [5], performance is an outcome of behavior. It is also noteworthy that there may be other factors than behavior alone influencing performance. Little, if any, research has examined how innovative behavior influences innovation performance. It may be worthwhile to examine this relationship in greater detail.

Our finding that personality does not moderate the effect of the network tie strength was unexpected. As limited prior research addresses the moderating effects of personality of antecedents to innovation performance, one contribution to the literature provided by our study is that we drew attention to the potential moderating effects of personality in the context of networks and innovation. We argued for the hypothesized moderation based on the temporal order of variables and on Kirton's [18] observation that personality stimulates network building in the workplace and, in turn, employees' innovation (performance). Finding no support for personality moderating the effect of network tie strength on innovation performance indicates that the relationships among variables may need to be reconsidered. While personality does not seem to moderate the effect of network tie strength, personality may be an antecedent of networks, and network tie strength in particular. Such a temporal order appears to be supported by recent research that shows personality affects a person's network, especially the strength of network ties [14]. Recalling that personality exists prior to both the network and work performance, it seems reasonable to expect that, instead of personality moderating the effect of network tie strength, personality has a direct effect on work performance, i.e. innovation performance, and an indirect effect via network tie strength, that is the strength of network ties mediates the effect of personality on work performance. We tested for the indirect effect of personality via network tie strength on innovation performance for both conscientiousness and extraversion, to find no support for an indirect effect via the strength of network ties.

In sum, the findings of our study show that (1) the strength of network ties and personality, i.e. conscientiousness and extraversion alone and in combination, have direct effects on work performance, (2) personality does not moderate the effect of network tie strength on work performance, and (3) network tie strength does not mediate the effect of personality on work performance.

### **Limitations and Suggestions for Future Research**

Our findings may be affected by the limitations of our study. The cross-sectional nature of the study means that we could not determine causality and the sample size limits our opportunity to employ statistical techniques that could provide an indication of causal directions. While this may constitute a limitation to our study, the hypotheses were developed based on past research and as our main relationships hypothesized were supported. Thus, we do not consider the cross-sectional nature of our study to be a serious threat to the validity of our findings.

Another potential limitation to our findings stems from using a questionnaire. We conducted a Harman one-factor test that did not indicate that common methods variance posed a serious threat to our findings [35].

We obtained the data for our study from a focused sample of engineers and university faculty in the area of the sciences. By its' nature, science-based work requires employees to be systematic, careful, and thorough; all traits inherent in conscientiousness [21]. Consequently, the sample may limit the external validity of our findings to employees engaged in scientific oriented work. The study participants were all employed in Thailand, which may also present a limitation to our findings. The variable means shown in Table 1 indicate that, on average, the respondents agreed with the item statements in the questionnaire. This could imply that the respondents

provided socially desirable responses. While we did not test for social desirability, that the sample is based on employees in Thailand and the variable means may raise a concern that the responses are affected by social desirability. Only future research will have potential to reveal if our findings are based on socially desirable responses.

We were surprised to find that personality did not moderate the effect of the strength of network ties. Yet, as expected we found that both the strength of network ties and personality, in the form of conscientiousness and extraversion, impact innovation performance while other researchers [34] did not find the same personality factors were associated with innovation behavior. Given that performance is the outcome of behavior [5], there appears to opportunity for elucidation of the casual process from the strength of network ties and personality via behavior to innovation performance in multiple work and cultural contexts in future research. Lastly, as our study focused on employees' innovation performance at the individual level, future research may prove fruitful in examining innovation performance at the group level for supervised groups, self-directed groups, and self-managed groups.

### Conclusion

This study advances our collective knowledge by showing that employees' network within an organization independently influence employees' work performance. Specifically, our findings show that the strength of network ties constitutes an important independent factor that explains innovation performance. Our findings also advance our knowledge by showing that the effect of strength of employees' network ties on innovation performance is not moderated by employees' personality. The study further advances our knowledge by showing that personality explains, in part, employees' innovation performance.

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