

Exploring The Relationship Between Leadership Behaviors and Individual Innovation Effectiveness Among Administrators of The Northeastern TVET Institutes In Cambodia

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Abstract.

Understanding organizational behavior and leadership via complex, linked dynamics that create an environment for organizational learning, flexibility, and innovation is known as complexity leadership. Hence, this study aimed to explore the relationship between leadership behaviors and individual innovation effectiveness among administrators of the Northeastern TVET Institutes in Cambodia. The study used a cross-sectional survey design and a quantitative research approach. The samples were 120 administrators from the Northeastern TVET Institutes completing the surveyed questionnaires. Collected data were analyzed using descriptive and inferential statistics via computer software. The correlation matrix revealed numerous pairs of associated items, and three Pearson r tests were significantly and moderately connected. All three null hypotheses were disproved, and both simple and multiple linear regression produced significant regression equations. There was a stepwise regression. Regression analysis revealed a significant equation. Setting clear goals and deliverables was equivalent to the participants' anticipated level of individual creativity. By identifying empirical evidence indicating statistically significant connections between complexity leadership and individual innovation inside an organization, the study filled a gap in the literature. In order to foster individual innovation, all leaders should ambidextrously supply agents in networks both dampening (administrative) and amplifying (generative) input. This study suggests that leaders need to set clear goals and deliverables.

Keywords: Leadership Behaviors, Individual Innovation Effectiveness, Administrators and Northeastern TVET Institutes.

I. INTRODUCTION

In the twenty-first century, the social and economic landscape has changed to become more intricate, unpredictable, and interconnected (Clemens, 2013; Sok et al., 2026a; Sok et al., 2026b). Ideas, intellectual property, skill, and technique are the main resources for business development in the knowledge economy, a specific type of entrepreneurship (Mok et al., 2026a; Stingl, 2021). In the knowledge economy, institutes/universities both receive and influence policy changes (Barrett, 2019; Mok et al., 2026b). Institutions and universities must be flexible for a number of reasons. Through their teaching, research, and public service objectives, universities serve as vehicles for advancing knowledge and transferring growth-oriented motives to their economic and social contexts (Olo et al., 2021; Mok et al., 2026b). By challenging preconceived notions, gathering necessary resources, concentrating strategic energy, and outlining a clear goal, leadership is required to change the culture of higher education institutions (Soliday & Lombardi, 2019). A fresh perspective on leadership is provided by complexity science, which uses complexity dynamics like dependency and self-organization to provide adaptive results (Uhl-Bien & Marion, 2009).

A post-heroic viewpoint that contends that leader behaviors are unpredictable, nonlinear, collaborative, distributed, fluid, relational, and complicated (Regine & Lewin, 2000; Denis et al., 2012; Clarke, 2013; Mok et al., 2026b) has emerged in reaction to shifting social and economic dynamics. Universities can be viewed as complex organizations that can be viewed as systems thanks to complexity leadership (Mok et al., 2026a; Walters, 2021). According to Hazy and Prottas (2018), complexity leadership behaviors are interactions that direct group behavior and, when taken as a whole, create a system. Other group interaction behaviors that function within the system are either amplified, dampened, or supported by the new, local, synergistic interaction behaviors (Hazy & Prottas, 2018). Using an organization's dynamic capacities to meet adaptive issues is the ultimate goal of complexity leadership (Uhl-Bien et al., 2007).

Institutes must be innovative in order to meet the expectations of the twenty-first century (Al-Lail & Mohamed, 2019; Mok et al., 2026b). As knowledge workers handle ambiguity, embrace new concepts, and

implement change, individual inventive behaviors are crucial (Aldahdouh et al., 2019). According to Kemer and Altuntaş (2017), an individual's innovative behaviors can be defined as their belief that a product, service, or concept is novel. Individual creative actions support the achievement of organisational goals (Aldahdouh et al., 2019). This study examines the association between individual innovative behaviors and complexity leadership in TVET Institutes. Thus, the study's goal was to explore the relationship between leadership behaviors and individual innovation effectiveness among administrators of the Northeastern TVET Institutes in Cambodia. The research question was the main emphasis of this empirical study: *To what degree, if any, do complexity leadership behaviors predict individual innovative behaviors in the Northeastern TVET Institutes in Cambodia?*

The brief literature review that follows describes research projects and dissertations that have research questions similar to those in this study. This review aims to do four things: (a) show that some organisational theorists have stated that complexity leadership is supported as a theory; (b) show that some other theorists have suggested that complexity leadership is best viewed as a metaphor; (c) explain that there is a gap in the literature regarding complexity leadership and innovation in universities; and (d) provide evidence of empirical studies that support the claim that complexity leadership may significantly predict innovation in organizations.

Complexity leadership may be a theory, say some theorists. Uhl-Bien et al. (2007) provided a unified framework for investigating complexity leadership theory in the most cited complexity paper. Uhl-Bien et al. (2007) identified four orienting assumptions of CLT: (a) it is enmeshed in a bureaucratic superstructure through which leaders enact administrative and generative leadership functions, (b) distinct enabling and adaptive functions exist across levels of the organization, (c) the complex adaptive system is the unit of analysis, and (d) leadership is an interaction. Other studies that identify complexity leadership (Dawson et al., 2018; Hazy & Prottas, 2018; Horvat & Filipovic, 2018; Lichtenstein, 2006; Uhl-Bien & Marion, 2009).

This study used Hazy and Prottas (2018)'s instrument, building on Uhl-Bien et al. (2007) and Marion (2009). This study argues that complexity leadership is a theoretical framework. The tension in this study—using positivism to assess an emergent theory—is not new. Schneider and Somers (2006) recognized the ambiguity of complexity theory and its limitations in advancing leadership implications. The authors then produced hypothetico-deductive propositions with variables and recommended positive research methodologies. Complexity leadership theory needs conceptual refinement (Rosenhead et al., 2019) and empirical testing (Hazy & Uhl-Bien, 2015; Schneider & Somers, 2006). The research should use multilevel modelling, simulation, and enhanced data analysis (Hazy & Uhl-Bien, 2015). This study shows that complexity leadership theory predicts creativity.

Reviews of complexity leadership critiques cover their different perspectives and research findings. A 4-year ethnographic study of a public-sector organization by Houchin and MacLean (2005) examined strategic change from a complexity perspective. The authors questioned using complexity science to organisational human behavior studies. They wanted to study complexity science as a metaphor for organisational development over four years. They concluded that complexity leadership theory should integrate socially built rules and anxiety, which influence human behavior. In a conceptual essay, Clarke (2013) used complexity science to describe complexity leadership and emphasized that human behavior may not help CAS dynamics. Clarke stated that applying complexity science to leadership is difficult and that complexity scientific theories may simply be metaphors for human behavior and learning.

After reviewing complexity leadership literature, Rosenhead et al. (2019) found uneven implementation of complexity science ideas in leadership. The authors emphasized that complexity leadership had multiple theoretical bases and had not yet been unified. Complexity leadership may be a metaphor, but even that position was precarious due to insufficient linkages to complexity science. With better complexity leadership, they believed the situation may improve. Some studies failed to link complexity leadership to innovation in higher education. Walters (2021) took a complexity leadership approach to South African university leadership. The results showed that university executives have little understanding of complexity science, leadership, and how it may help higher education. Instead, disorder and chaos were seen as threats to the university rather than inherent situations that complexity leadership might resolve.

Complexity leadership and innovation research in higher education was scarce. In a qualitative study on learning analytics in universities, Tsai et al. (2019) discovered that complexity leadership might build and nurture an adaptive space for radical/exploratory innovation. Tsai et al. concluded that complexity leadership revealed how to operationalize administrative leadership. Organizations outside education have more complexity leadership research. In complexity leadership, Akgün et al. (2014) operationalized adaptive/entrepreneurial leadership. The independent variables were adaptive leadership, product innovativeness, and complex adaptive system processes. They observed that adaptive leadership and CAS mechanisms positively, significantly affected product innovativeness and firm product innovativeness.

In a nationally representative sample of Canadian enterprises, Li et al. (2018) examined complexity emergence. Through collective information exchange and aggregation, high-involvement workers could increase creativity, the researchers discovered. Innovation's strategic relevance, high-involvement experiences' similarity, and firm knowledge upgrades boosted the favorable effect. In South African enterprises, Diesel and Scheepers (2019) studied complexity leadership, innovation climate, and innovation. The organisational innovation climate benefited from complexity leadership. Both complexity leadership and innovation climate boosted exploitative innovation but not radical innovation. Glover et al. (2020) found linear thinking, autonomy, and performance orientation varied among 31 hospital units. Members of CAS should balance emergent and regulated behavior to maximize innovation performance

II. METHODS

The study used a deductive theoretical method and a positivist epistemological stance. A positivist epistemological stance is one that supports using natural scientific techniques to investigate social reality and other topics (Bryman, 2012). A deductive theoretical approach involves the deduction and empirical testing of a hypothesis (Bryman, 2012). The method was cross-sectional and quantitative. Objective theories are evaluated in quantitative research by looking at the relationships between variables, which are usually measured with scale-equipped equipment and then statistically analyzed (Creswell & Creswell, 2018). A cross-sectional survey approach gathers data all at once (Creswell & Creswell, 2018). Two validated quantitative survey instruments—the Complexity Leadership Interaction Modes (CLIM) scale by Hazy and Prottas (2018) and the Individual Innovative Behavior Scale (IIBS) by Kleysen and Street (2001)—were used to measure participants' behaviors in order to test the study's hypotheses.

This study was conducted with total of 120 administrators from the Northeastern TVET Institutes in Cambodia. Interest in the subject is a major driver of survey completion (Zillmann et al., 2014). Finding a response community that would be interested in novel behaviors was therefore crucial. University-educated potential responders who work full-time are more likely to finish a survey (Fulton, 2018). Consequently, full-time employees who were anticipated to hold a university degree since they work at a college were identified as the research population. An innovative TVET Institutes was chosen to take part in the research.

The Northeastern TVET Institutes Telegram group was used to administer the survey, which was disseminated electronically. Following the introduction email, each participant was instructed to complete the informed consent form and the Qualtrics survey using the given link. The voluntary nature of the study, the confidentiality of responses, and the ability for participants to withdraw at any time were all explained in the informed consent form. For sixty days, the survey was accessible thanks to the researcher. Secure handling and storage of the data took place. Respondents filled out the Individual Innovative Behaviors scale to report their perceptions of their own individual innovative behavior and the CLIM scale to give their perceptions of observed leadership interaction behaviors within their immediate work groups.

The CLIM scale and IIBS analyses were conducted using the Statistical Package for the Social Sciences (SPSS). The elements in the two CLIM subscales pertaining to complex leadership interaction behaviors served as the independent variables. The IIBS elements pertaining to individual innovative behaviors were the dependent variables. To identify the best parametric or non-parametric tests to examine any correlations between the variables, descriptive statistics and tests for normalcy were carried out. Each of the CLIM subscales—Administrative Leadership Mode (ALM) and Generative Leadership Mode (GLM)—as well as the IIBS underwent an internal reliability test using the Cronbach alpha coefficient. The existence

and importance of links between the independent and dependent variables were assessed using Pearson's r correlation coefficient. To investigate the connections between every pair of variables in the dataset, a Pearson r correlation matrix was generated.

III. RESULT AND DISCUSSION

Results of Internal Reliability Test with Cronbach Alpha Coefficient

As a measure of internal consistency, the Cronbach alpha coefficient test is also a test of dependability since it establishes the degree to which each item evaluates the same construct (Cronk, 2012). An internal reliability test using the Cronbach alpha coefficient was used to evaluate the ALM, GLM, and IIBS. The Cronbach alpha coefficient was evaluated using the standards provided by George and Mallery (2019): $> .9$ = excellent, $> .8$ = good, $> .7$ = acceptable, $> .6$ = questionable, $> .5$ = poor, and $\leq .4$ = unacceptable.

Table 1: Presenting the Analysis of ALM, GLM, and IIBS Reliability

No.	Scale	# of Items	Alpha	Lower bond	Upper Bond
1.	ALM	5	0.90	0.85	0.90
2.	GLM	5	0.81	0.71	0.84
3.	IIBS	14	0.96	0.96	0.96

With a Cronbach's alpha coefficient of ≥ 0.70 , the variables for the CLIM subscales, the ALM, and the GLM all showed good consistency. As indicated in Table 9, the variables for the IIBS have a Cronbach alpha coefficient = 0.96, showing strong internal consistency of the scales.

Results of Summary ALM, GLM, IIBS Statistics

This study examined the existence, direction, and strength of a predictive association between complexity leadership behaviors (independent variable) and individual innovation in the Northeastern TVET Institutes. It was measured complexity leadership with the CLIM scale and individual innovation with the IIBS. This chapter describes the sample, data collecting, research process, and data on study participant demographics. It displays the answer to the study question and hypotheses using inferential statistics.

Table 2: Summary ALM, GLM, IIBS Statistics (n=120)

No.	Variables	Range of Scale	M	S.D.
1.	ALM	1-7	2.88	1.56
2.	GLM	1-7	2.85	1.54
3.	IIBS	1-6	4.16	1.15

The ALM, GLM, and IIBS (N = 120), the continuous variables of interest, had their means and standard deviations determined. Table 1 displays the ALM, GLM, and IIBS summary data. The average ALM and GLM scores were 2.88 and 2.85, respectively. Managers responded that, on average, between one and twenty instances of administrative and generative complexity leadership behaviors had taken place in their immediate work groups during the previous three months. 4.16 was the average IIBS score. Managers generally stated that they engaged in individual innovative behaviors quite frequently. All of the instruments' item standard deviations were between 1 and 2, suggesting a little dispersion.

Table 3: Presenting Items, Mean (M) and Standard Deviation (SD) of CLIM (n=120)

No.	CLIM Items	M	S.D.
1.	Encouraging responsibility	2.94	1.79
2.	Establishing impartial success or failure metrics	2.85	1.45
3.	Silencing voices that divert attention from the goal	2.07	1.05
4.	Requesting more time and effort from others	2.75	1.73
5.	Setting precise goals and deliverables	3.04	1.38
6.	Endorsing divergent viewpoints	2.89	1.51
7.	Giving people the tools and time to experiment	3.11	1.57
8.	Encouraging learning visits to other organizations	2.35	1.35
9.	Promoting innovative methods	2.98	1.55
10.	Pardoning failure	2.77	1.52
Total		2.77	1.48

Table 3 displays the individual analyses of the CLIM scale items. "Silencing voices that divert attention from the goal" received a complexity leadership behavior score of 2.07, which was the least frequently

observed in work groups over the last three months, or one to ten times. 3.11 for “*Giving people the tools and time to experiment*” was the complexity leadership behavior that was most commonly reported in work groups over the previous three months, or 11 to 20 times.

Table 4: Presenting Items, Mean (M) and Standard Deviation (SD) of CLIM (n=120)

No.	CLIM Items	M	S.D.
1.	Find ways to improve a process, technology, product, service, or connection.	4.61	1.06
2.	Recognize ways to improve your work, department, company, or customers.	4.50	1.11
3.	Notice non-routine concerns in your workplace, department, company, or market.	4.27	1.13
4.	Come up with concepts or fixes for issues	4.56	1.06
5.	Expand problem definitions for better understanding.	3.96	1.15
6.	Try out novel concepts and solutions.	4.05	1.06
7.	Try out concepts or fixes for unmet needs.	3.79	1.09
8.	Assess new ideas' pros and cons.	4.02	1.17
9.	Try to convince others of the value of a fresh idea or solution.	3.88	1.25
10.	Actively promote ideas for implementation.	3.75	1.18
11.	Take a chance by endorsing novel concepts.	3.94	1.14
12.	Make adjustments that appear to be advantageous.	4.21	1.07
13.	Fix faults by applying innovative ways to a process, technology, product, or service.	4.03	1.13
14.	Add fresh ways to improve a process, technology, product, or service to daily activities.	3.97	1.04
Total		4.11	1.12

Table 4 displays the results of the individual analyses of the IIBS items. “Actively promote ideas for implementation” was the specific innovative behavior that was described as occurring the least frequently, or between occasionally and quite regularly, with a score of 3.75. “*Find ways to improve a process, technology, product, service, or connection*” was the most commonly reported innovative behavior, with a score of 4.61, falling between somewhat frequently and very frequently.

Referring to the findings above, while some complexity leadership research studies only used the ALM and GLM behaviors (Callens, 2024; Cureton, 2020; Hurny-Fricano, 2021), others included adaptive behaviors in addition to administrative and generative behaviors (Horvat & Filipovic, 2018; Laufer et al., 2025; Schophuizen et al., 2023). Because Hazy and Prottas' (2018) factor analysis produced a two-factor answer when creating the CLIM instrument, this study only used the administrative and generative behaviors. Additionally, this study provided some support for the CLT model in Marion and Uhl-Bien's (2001) second-most-cited journal paper on complexity leadership. Innovation, ideas, cooperation, fitness, and extinction were the results of the Marion and Uhl-Bien 2001 model. The GLM item that supports differences of opinion (Hazy & Prottas, 2018) is consistent with the complexity leadership concept of Marion and Uhl-Bien (2001), which is about empowering individuals to overcome competing restrictions. Thus, this analysis lends some credence to the work of Marion and Uhl-Bien (2001).

The findings of Rosenhead et al. (2019), who contended that it was questionable whether complexity leadership could be used as an analogy for the field of study, were not supported by this study. Instead, this study reinforced the idea that complexity leadership may be defined as a theory, quantified, and demonstrated to be causally associated with innovation in a specific context. The study's conclusions may be different from those of Houchin and MacLean (2005) and Rosenhead et al. (2019) because, prior to the CLIM by Hazy and Prottas (2018), there does not seem to have been a trustworthy complexity leadership scale that theorists and researchers could have used. According to Ramos et al. (2016) and Uhl-Bien and Arena (2018), a company must be ambidextrous in order to sustain long-term flexibility and viability, striking a balance between the demands of productivity and efficiency and innovation. By demonstrating that both administrative and generative complexity leadership behaviors predicted individual creativity, our study validated the organisational ambidexterity assumption put forward in those two conceptual articles.

Results of Inferential Statistics Analysis

Participants' individual inventiveness was predicted using a straightforward linear regression depending on how complex the leadership behaviors they saw were. It shows the significant regression equation ($F(1, 83) = 12.336, p < 0.001$) with an R^2 of 0.129. Therefore, the degree of complexity in the leadership behaviors that participants witnessed can predict 12.9% of the difference in individual

innovativeness. Based on the degree of administrative complexity and generative complexity leadership behaviors that participants saw, a multiple linear regression was computed to predict each participant's level of innovativeness. Findings demonstrate the significant regression equation ($F(2, 82) = 6.098, p < 0.005$) with an adjusted R^2 of 0.108. Therefore, the degree of administrative and creative complexity leadership behaviors witnessed by participants can predict 10.8% of the diversity in individual innovativeness. Using complexity leadership behaviors and the demographic variable as predictors, a stepwise regression was used to determine the most significant predictor or predictors of individual inventive behaviors.

Table 5: Presenting the ANOVA for Stepwise Regression (n=120)

ANOVA ^a					
Model	SS	df	MS	F	p-value
1 Regression	1282.187	1	1282.18	9.765	0.002 ^b
Residual	10899.99	95	131.325		
Total	12185	94			

Note: ^a Dependent variable: IIBS total

^b Predictors: (Constant), Setting precise goals and deliverables

Table 6: Presenting the Coefficients of Stepwise Regression (n=120)

Coefficients ^a						
		Unstandardized Coefficients		Standardized Coefficients		
		B	SE	β	t	p-value
1	(Constant)	48.388	3.066		15.85	< 0.001
	Setting precise goals and deliverables	2.899	0.936	0.335	3.128	0.002

Note: ^a Dependent variable: IIBS total

Tables 5 and 6 demonstrate the significant regression equation ($F(1, 83) = 9.765, p < 0.005$) with an adjusted R^2 of 0.095. Therefore, the number of specified goals and deliverables that participants saw in their immediate work groups during the previous three months can predict 9.4% of the difference in individual innovativeness. Individual inventive behaviors anticipated by participants = $48.388 + 2.899$ ("Setting precise goals and deliverables"). To put it another way, the average manager is 2.895 times more likely to engage in individual innovative behaviors themselves (on a 6-point scale ranging from never to always) if they witness others in their immediate work groups. The Northeastern TVET Institutes' individual inventive behaviors were predicted by the CLIM scale and its two subscales, ALM and GLM. The results of the simple linear regression showed that observed complexity leadership behaviors can predict 12.9% of individual innovativeness (sig. < .001). The results of the multiple linear regression showed that administrative and generative complexity leadership can predict 10.8% of individual innovativeness (sig. < 0.005). The stepwise regression showed that a single complexity/administrative leadership behavior can predict the proportion of individual innovativeness (sig. < 0.01). The results of this study showed a connection between individual innovative behaviors and complexity leadership behaviors. While the dependent variable in this study was individual innovation, it was not the same as the dependent variable in previous studies. Only two dissertations and one research project have used the CLIM, which was one of the first validated complexity leadership scales created (Cureton, 2020; Hurny-Fricano, 2021; Mai & Do, 2023). Three more well-known complexity researchers (Diesel & Scheepers, 2019; Khan et al., 2021; Ross et al., 2018) created validated complexity leadership scales. Other researchers do not seem to have used any of the other complexity leadership scales. This led to a dearth of empirical studies demonstrating the connection between organisational innovation and complexity leadership.

The CLIM was utilised in two earlier PhD dissertations to forecast connections with innovation in American businesses. In their investigation, Mai and Do (2023) combined the CLIM with the dependent variable of organisational high performance. The team behaviors of learning and efficacy were both outcomes and mediating factors in Cureton's (2020) regression study, which revealed statistically significant correlations between the CLIM and the organisational outcome of support for innovation. Cureton (2020) examined the GLM, ALM, and CLIM. The CLIM scale was used to measure complexity leadership

behaviors in an organisational setting in both Cureton's (2020) study and this one, which filled the same gap in the literature by finding empirical evidence of important connections between complexity leadership and organisational innovation. The two PhD research confirmed that complexity leadership is a quantifiable theory in this way. The impact of Uhl-Bien et al.'s (2007) three complexity leadership functions on innovation in educational contexts was examined in three recent qualitative studies (Ho et al., 2025; Laufer et al., 2025; Schophuizen et al., 2023). The three kinds of behaviors described in Uhl-Bien et al.'s (2007) theoretical framework—administrative, generative, and adaptive—were used by all three research to frame their knowledge of complexity leadership. They were different from this study in that it solely employed the complexity leadership model's generative and administrative leadership roles. The three kinds of leadership behaviors—administrative, generative, and adaptive—supported the framework for institutional innovation in educational contexts, according to all three qualitative investigations (Ho et al., 2025; Laufer et al., 2025; Schophuizen et al., 2023).

IV. CONCLUSION

This research revealed favorable, statistically significant outcomes that endorse the concept that complexity leadership behaviors forecast individual innovative actions of leaders in the Northeastern TVET Institutes of Cambodia. All three independent factors forecasted the dependent variable (the IIBS) at the Northeastern TVET Institutes; hence, all three null hypotheses were dismissed. A solitary element from the ALM, delineating particular objectives and outputs, forecasted fluctuations in the IIBS. This research provides a notable original addition by filling a void in the complexity leadership literature: it demonstrates that a theory may indeed be quantified. This research further enhances the examination of leadership within higher education by illustrating that, in Northeastern TVET Institutes, complex leadership behaviors forecast individual innovative actions. The results of this study will help human resource managers understand what should be considered when hiring and developing organisational leaders. Human resource management should look for leaders who perceive organizations as dynamic, open systems whose job it is to foster organisational learning, flexibility, and creativity. In order to handle problems as they emerge and to use a systems perspective to identify where solutions cascade up to a level of emergence, leaders should be hired and trained to create and maintain networks of agents within the company and with external stakeholders. In order to maximize individual creativity, leaders should be educated to give networks both dampening (administrative) and amplifying (creative) input. Several generalizations regarding the complexity leadership study agenda can be made because there is currently a lack of empirical research on the function of complexity leadership behaviors in organizations and how they support organisational results.

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