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Organizational Commitment and Engagement Practices from Applying Green Innovation to Organizational Structure: A Case of Thailand Heavy Industry

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Abstract. Green innovation has been valued as a mechanism to reduce environmental impacts, which can increase organizational commitment and engagement propensities for environmental sustainability. This paper aimed to understand: (1) how does green innovation recognition affect the organizational structure? and (2) how can organizational structure help most internal stakeholders commit and engage in the organization's environmental objective? The data from 250 Thai heavy industrial organizations were collected. The results showed that there were significant relationships among green innovation recognition, organizational structure, and organizations' environmental commitment and engagement. Besides, the intermediary role of differentiation and integration showed a significant influence on commitment and engagement. Our paper suggests that policymakers and entrepreneurs should introduce green innovation to their organizations to heighten the level of environmental sustainability in their strategy and policy.

Keywords: Green innovation; Organizational commitment; Organizational engagement; Organizational structure; Thailand

1. Introduction

In the past two decades, most organizations have become more aware of environmental crises and anthropogenic activities impacting it. Green innovation is the practical models for leveraging and implementing innovative effects in the organizational analysis in terms of environmental aspects (Calza et al., 2017). Green innovation is an essential strategic catalyst for enacting structural changes and engages and commits organizations to understand sustainability, including the involvement of technological innovation in waste-recycling, pollution-prevention, and energy-saving (El-Kassar and Singh, 2019). Global warming and climate change are environmentally caused by economic and business activities, whether inside organizations or not (Patz et al., 2005), this requires sustainability to create alternative designs and stimulate innovation (Suwartha et al., 2017).

Green innovation at the organizational level has been widely recognized as an important means of endpoint ecological competition. The work of Yang et al. (2017) confirms that the environment can be improved by implementing green innovation into

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organizations. Moreover, green innovations help to improve organizational efficiency, competitiveness, and the green image of the organization by permitting them to have eco-friendly improvements in terms of products, processes, and managerial aspects (Yusuf et al., 2018). Armando's (2016) empirical work found that a well-design organizational structure impacts a firm's innovation output. Thus, if organizational structure decides to adopt and absorb innovation, the recognition of innovation is required (Naruetharadhol et al., 2020). As a result, we pose these key research questions to understand this phenomenon as follows: firstly, how does green innovation recognition affect the organizational structure? Secondly, once that effect is delivered, how can the organizational structure deliver such recognition to commit and engage most internal stakeholders in the organization's green objective?

From a theoretical standpoint, Rogers (2003) defines the innovation adoption process in stages, including recognition (i.e., individuals recognize the knowledge of innovation), consideration (i.e., individuals form an attitude towards the innovation), intention (i.e., individuals decide to adopt the innovation), adoption decision (i.e., individuals implement the innovation), and continuum of use (i.e., individuals continuously confirm the use of the innovation). Frambach and Schillewaert (2002) theoretically identify the innovation adoption process in two stages: initiation and implementation. In the initiation stage, the adoption process encompasses the awareness, consideration, and intention substages. Hence, this current research problem involves the awareness substage of the innovation adoption process, in which the concept of green innovation is recognized and introduced within organizations but not yet adopted.

There was only empirical evidence's Damanpour and Gopalakrishnan (1998) to support the phenomenon of the organizational structure's effect on innovation. This relationship between organizational structure and innovation is an attempt to explain the working styles that support and absorb innovations (Ali et al., 2018). Besides, Menguc and Auh (2010) found that the informal structure has a positive impact on radical and incremental product innovation capabilities. This indicates that if individuals' personalities and professional requirements are informally authorized to design this professional behavior, it will increase the capabilities of innovations, necessitating different means of learning from inside and out. This stage of the innovation process represents the success of innovation or the innovation-adoption decision stage but is beyond the recognition stage.

Our knowledge gap exists in the commitment and engagement propensities from recognizing green innovation offered. Consequently, this current research focuses on the stage of recognition, which will most likely allow them to understand its essence gradually. In doing so, when an organization realizes environmental issues, it becomes more complex for individuals in different specialised departments to correspond to one another. This creates pressure for integrative mechanisms such as top management group to ensure that those in charge of distinct functions that are aware of environmental issues from their activities. Organizational structure, therefore, has an intermediary role to link green innovation recognition with commitment and engagement.

As a result, it is assumed that when the organization recognizes or introduces green innovation, this may induce a positive change in the organizational structure. The work difference in structure matters to coordinate their work activities among functional departments, this relates to organizational differentiation and integration. What is more, if organizational structure may change due to the recognition of green innovation, it is possible to increase organizational commitment towards environmental goals since it enables internal stakeholders (especially employees) to be satisfied with the organization's green concerns. Kim and Shin (2019) found that the willingness to accept the organization's green

initiatives or goals is revealed in the organizational structure, wherein the psychologically empowering process of transformational leadership behaviors is effectively induced. Concurrently, the organizational structure will also affect organizational engagement; Funminiyi (2018) founds that a decentralized structure of control tends to support employee productivity and increase employee performance. Thus, when the management motivates employees to become aware of the green innovation concept, this phenomenon will give them either a positive or negative attitude towards the organization. It creates a platform where employees can be fully engaged, which is what organizations want: higher performance from employees. Organizations also need to encourage the strength of organizational attachment toward environmental sustainability or the surrounding environment — this refers to organizational commitment to the environment. While environmental problems become aware, organizations need to change their behaviors to involve sustainability — this refers to organizational engagement in environment. Taking all the above into account, we form hypotheses to answer those questions (see Figure 1).

2. Methods

2.1. Data Collection and Sampling

In this current research, the research design for data collection was based on the field survey. We focused on Thailand's heavy industry; the number of industrial factories is 41,774 throughout the country, as shown in Table 1. The sample size determination was estimated based on a 1:10 ratio for each item (question asked). This sample ratio for the structural equation model was recommended by Kline (2015). Thus, the minimum sample size was appropriated to 210 organizations (10×21 questions). In order to observe these samples, the two-stage sampling methods were applied. First, one-stage cluster sampling was used to determine the number of samples that would be collected in each geographical region of Thailand, where are clustered into the Northern, the Northeastern, the Central, the Eastern, the Western, and the Southern. Then, the purposive random sampling was applied to reach those samples in heavy industries solely. The data collection tools were operationalized by email since the department of industrial works has provided full contact, and telephone was used to track and confirm their voluntary response. The samples were obtained at 382 organizations. After the data cleaning process, the usable samples were available at 250 organizations, given 78.5% of the response rate (300/382 = 0.785). This amount is acceptable for the complex model (Baruch, 1999).

2.2. Survey Instrument

The survey instrument design and properties were composed of two sections as follows. The first section was designed to measure the characteristics of the target samples (e.g., respondent position, type of heavy industry, industrial factories' location, firm age, the number of employees). In the second section, all measures of the key variables have been phrased on the seven-point Likert scales, ranged from "1 = Not at all aware" to "7 = Strongly aware."

2.3. Measures and Variables

The measurement has been adapted and changed better fit the current research context. We attempt to test the green innovation recognition into the product, process, and management dimensions. This is because a second-order model of the green innovation recognition is explained by the latent class variables of green product innovation, green process innovation, and green managerial innovation. The recognition of green innovation, therefore, was measured using adapted and changed items (García-Granero et al., 2018). First, green product innovation was designed to capture the activities relate to

(GPI1)…using materials with lower environmental impact, (GPI2)…using recycled materials, and (GPI3)…using products with a longer life cycle. Second, the measurement of green process innovation was comprised of (GPR1)…acquiring machinery and software, (GPR2)…research and development, and (GPR3)…Recycling waste, water, or materials. Third, the item scale to measure green managerial innovation was based on (GMI1)…the protocol of environmental standard, (GMI2)…environmental criteria, and (GMI3)…initiating green management. The mediating variable, organizational structure, refers to the extent to which the organization allocates work roles, administrates mechanisms to control, and integrates work activities (Liao et al., 2011). In this study, the organizational structure was formed using the second-order model in which differentiation and integration were the first-order factors. First, the differentiation is defined as the degree to which the division within an organization creates areas of responsibility based on tasks or innovations offered (Armando, 2016), measured by items adapted from Armando (2016) and Lawrence and Lorsch (1967). As such, this captured the activities that pertained to (DIF1)…task specialization, (DIF2)…employees' professionalization, and (DIF3)…spans of control. Meanwhile, integration refers to the extent to which the organizations integrate and coordinate different divisions and tasks into cohesive outputs. Integration was measured using three items from (Lawrence and Lorsch, 1967; Liao et al., 2011), which were (INT1)…interdepartmental task forces, (INT2)… liaison personnel, and (INT3)… interdepartmental committees. (Morgan and Hunt, 1994) define organizational commitment as the employees' psychological attachment and willingness to accept organizational values and goals, to work hard as the organizational aspiration, and to stay as a group member. The items for organizational commitment were adopted from Meyer and Alien (1991); we self-developed the measures for organizational commitment to accommodate our research context: (OCM1—affective commitment)…happiness to stay when this organization would go green, (OCM2—normative commitment)...willingness to identify with values and goals on environmental concern that is promoted by this organization, and (OCM3—continuance commitment)… readiness to follow the environmental practices when this organization would go green. Finally, organizational engagement refers to the extent to which employees feel engaged in the organization and its goals (Funminiyi, 2018). In order to fit our research context, we self-developed and adapted the measures of organizational engagement from Kahn (1990) for (OEM1)…recognition of green innovation, (OEM2)…the organizational purpose on environmental aspects, and (OEM3)…leader-follower relations to communicate about the environmental goals.

Table 1 Clustering sampling calculation

Geographical location	Population (N = 41,774)	The probability of drawing the sample in each cluster	The minimum target drawn on the sample size (n = 210)	The final sample obtained (n = 250)
the Northern	3,383	8.10%	17	19
the Northeastern	29,134	69.74%	146	110
the Central	5,000	11.97%	25	80
the Eastern	902	2.16%	5	20
the Western	636	1.52%	3	6
the Southern	2,719	6.51%	14	15

2.4. Reliability and Validity Operationalization

The data analysis was conducted with several steps as follows. First, descriptive statistics were performed to understand the characteristics of the target sample and its distribution (see Table 2). Second, convergent validity was carried out by measuring the correlated assessment on other measures of similar constructs, composed of factor loadings, average variance extracted (AVE), and composite reliability. Third, discriminant validity was confirmed that there is a correlation with other different constructs. Fourth, the measurement model for confirmatory factor analysis (CFA) and structural model (SEM) would provide statistical insight allowing the proposed model to discuss in the next section.

The descriptive statistics (see Table 2) are summarized as follows. The largest numbers of the respondents 42% were the entrepreneur. 61.6% was from other heavy industries such as heavy product, heavy equipment, and car production. A 44% majority was located in the Northeastern region of Thailand, 32% was in Central. A majority of the organizations had 30 years or above of operations, accounting for 34%. A 57.6% majority had less than 200 employees, which was considered small organizations.

As exhibited in Table 3, convergent validity provided the statistical tools, consisting of factor loadings, composite reliability, and average variance extracted (AVE). The values of factor loading for each construct were higher than 0.50, indicating that the given indicators related to each of the factors (Hair et al., 2013). The composite reliability test for each construct exceeded the cut-off of 0.70, indicating the strong internal consistency in scale items. The average variance extracted (AVE) for each construct was greater than 0.50 (Fornell and Larcker, 1981), indicating that the good estimation of variance on a construct in relation to the variance of measurement error. To sum up, it is valid to test the model.

In order to estimate discriminant validity (see Table 4), the correlation coefficient must exceed the squared AVE between the construct and other constructs in the model (Fornell and Larcker, 1981), indicating no issue of multicollinearity.

Next, confirmatory factor analysis (CFA) was used to evaluate the structural validity of measurement model. The consequence of the CFA confirmed the measurements' high level of structural validity (Hair et al., 2013). The model fit indices for the overall measurement model were satisfied and acceptable: $\chi^2 = 390.97$ ($p < 0.001$); CMIN/DF = 2.327; RMSEA = 0.073; RMR = 0.057; AGFI = 0.825; PGFI = 0.635; CFI = 0.943; TLI = 0.929; IFI = 0.944.

The measurement model indices for the green innovation recognition (GIR) as a second-order factor showed that the model was acceptable: $\chi^2 = 69.974$ ($p < 0.001$); CMIN/DF = 2.916; RMSEA = 0.088; RMR = 0.046; AGFI = 0.893; PGFI = 0. 503; CFI = 0. 97; TLI = 0.955; IFI = 0.97.

The measurement model indices for organizational structure as a second-order factor revealed that it was acceptable: $\chi 2 = 9.098$ ($p = 0.001$); CMIN/DF = 1.137; RMSEA = 0.023; RMR = 0.019; AGFI = 0. 969; CFI = 0. 999; TLI = 0.998; IFI = 0.999.

Finally, the structural equation model was confirmed to test the proposed hypotheses. The fit indices for the structural model were as follow: $\chi^2 = 439.815$ ($p = 0.001$); AGFI= 0.811; CFI= 0.934; PGFI = 0.664; IFI= 0.934; TLI=0.923; RMSEA= 0.076; RMR=0.07 and CMIN/DF= 2.443. All indices showed a good fit of the statistical model (Hair et al., 2013).

Table 2 The characteristics of the sample

	Categories	Frequency	Percentage
Respondent position	Chief executive officer (CEO)	19	7.6%
	Top manager	41	16.4%
	Entrepreneur	105	42%
	Others	85	34%
Type of heavy industry	Transportation	11	4.4%
	Industrial machinery	35	14%
	Mining	5	2%
	Oil refining and steel production	13	5.2%
	Chemicals and Plastics	32	12.8%
	Others	154	61.6%
Age of industry	Below 10 years	62	24.8%
	10-19 years	68	27.2%
	20-30 years	35	14%
	30 or above	85	34%
Number of employees	Below 200	144	57.6%
	200-399	45	18%
	400-599	14	5.6%
	600-799	11	4.4%
	800-899	5	2%
	900-999	2	0.8%
	Above 1,000	29	11.6%

Table 3 Convergent validity

Dimensions		Items	Factor loadings	Composite reliability	AVE
Green Innovation recognition (GIR)				0.94	0.84
	Green Product Innovation	GPI1	0.88	0.87	0.69
		GPI2	0.80		
		GPI3	0.82		
	Green Process Innovation	GPR1	0.73	0.86	0.67
		GPR2	0.86		
		GPR3	0.87		
	Green Managerial Innovation	GMI1	0.85	0.85	0.65
		GMI2	0.71		
		GMI3	0.84		
Organizational Structure (OS)				0.88	0.78
	Differentiation	DIF1	0.86	0.88	0.72
		DIF2	0.85		
		DIF3	0.83		
	Integration	INT1	0.88		
		INT2	0.86		
		INT3	0.84		
Organizational Engagement in environment		OEM1	0.75	0.86	0.68
		OEM2	0.90		
		OEM3	0.81		
Organizational Commitment towards the environment		OEM3	0.82	0.87	0.68
		OEM3	0.86		
		OEM3	0.80		

Table 4 Discriminant validity matrix

	Sqr AVE	OS	GIR	OCM	OEM
OS	0.89	**0.89**			
GIR	0.92	0.87	**0.92**		
OCM	0.83	0.54	0.59	**0.83**	
OEM	0.82	0.73	0.64	0.72	**0.82**

3. Results and Discussion

The results of reliability and validity guaranteed to further test the structural models. The relationships between constructs were supported as all hypotheses were statistically accepted (see **Table 5** and **Figure 1**).

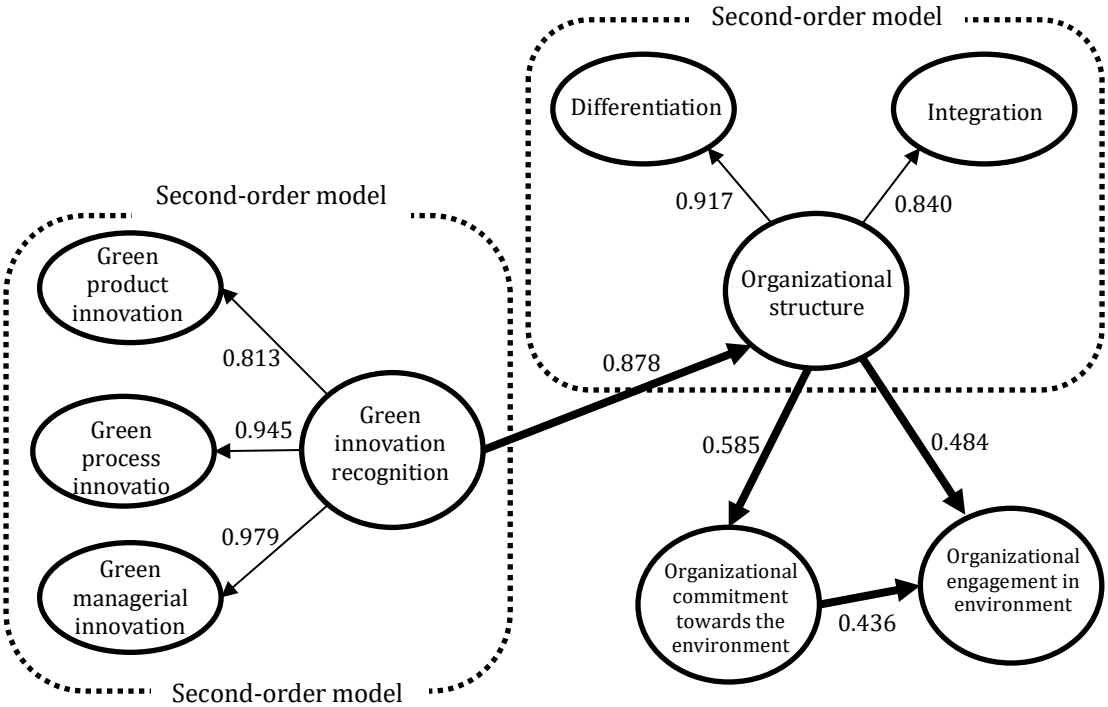

Figure 1 Structural model

Table 5 Structural and regression path analysis

Hypotheses	Path relationship	Standardized coefficient (β)	T-value	p-value	Results
H1	GIR —> GPI	0.813	12.748	***	Supported
	GIR —> GPR	0.945	12.721	***	Supported
	GIR —> GMI	0.979	12.231	***	Supported
H2	GIR —> OS	0.878	10.577	***	Supported
H3	OS —> DIF	0.917	12.025	***	Supported
	OS —> INT	0.840	12.025	***	Supported
H4	OS —> OCM	0.585	7.671	***	Supported
H5	OS —> OEM	0.484	6.352	***	Supported
H6	OCM —> OEM	0.436	6.086	***	Supported

***p<0.001

The results were shown that all hypotheses were supported. **H1,** testing the green innovation recognition as a second-order factor is influenced by the sub-dimensions of

green product innovation (β = 0.813, t-value = 12.748, p<0.001), green process innovation (β = 0.945, t-value = 12.721, p<0.001), and green managerial innovation (β = 0.979, t-value = 12.231, p<0.001), was supported. **H2** was confirmed to test the effect of green innovation recognition on organizational structure (β = 0.878, t-value = 10.577, p<0.001). Meanwhile, H3 was passed to form organizational structure as a second-order factor is explained by the sub-contexts of differentiation (β = 0.917, t-value = 12.025, p<0.001) and integration (β = 0.84, t-value = 12.025, p<0.001). The finding of **H4** that investigated the relationship between organizational structure and organizational commitment was supported (β = 0.585, t-value = 7.671, p<0.001). H5 tested the influence of organizational structure on organizational engagement shown the significant result (β = 0.484, t-value = 6.352, p<0.001). Finally, there was a confirmation of **H6** that examined the direct effects of organizational commitment on organizational engagement (β = 0.436, t-value = 6.086, p<0.001).

The recognition of green innovation relates to carbon emissions and reducing energy use, recycling waste, using sustainable resources, and designing green products, green process, and green managerial innovation is important for Thai heavy industries. In order to gain a competitive advantage beyond environmental issues due to social concerns, Thai heavy-industrial organizations need to introduce and recognize green innovation practices to reduce the environmental impacts of their economic activities. For example, this can prevent environmental issues such as a release of heavy metals into the environment. When they place emphasis on the essence of green innovation as a driver that influences the organizational structure, this, in turn, enhances the way to commit and engage within organizations to achieve environmental goals. This is consistent with the works of Ali et al. (2018) and Menguc and Auh (2010), who support that innovation is a mechanism to reduce environmental impacts. Green technological innovation plays a critical role in expediting the transition to a sustainable development model (Berawi, 2018).

This implies that the organizations can consider green innovation to increase the environment's performance and respond to environmental needs from outside. Moreover, organizations can activate innovation by gathering new knowledge in order to create useful ideas under the flexible structure of functional responsibility (Damanpour and Gopalakrishnan, 1998). Differentiation is an important component to consider during the process of designing the organizational structure of the heavy industries. The evidence of this current research indicates that organizational structure in the styles of differentiation and integration has a positive effect and is important on the organization's environmental commitment. Also, organizational structure changes affect employee engagement when employees reveal a high degree of affective commitment when they have a positive attitude and relationship to their organization to recognize the going green strategy. However, if employees' engagement increases, the organization's commitment increases as well, helping to achieve the organization's environmental objectives. The implications can be proposed to managers and policymakers that the recognition of green innovations is essential to understand and recognize these dimensions into the organizational resources and task specification. This will help entrepreneurs and managers whose decision-making strategies and policies aim at the introduction of green innovation to the leader-follower work chart. Furthermore, it can help entrepreneurs and managers successfully promote green innovation practices in their firms, increasing employees' commitment and engagement in green concerns, which is a significant factor for the implementation of green innovation practices at the organizational level.

4. Conclusions

This research aimed to understand the influence of green innovation recognition to foster organizations' environmental commitment and engagement, wherein organizational structure plays an intermediary role in achieving them. Our contribution to the literature on green innovation is twofold. First, we highlight the role of green innovation recognition — that is, the recognition to make a change at the process of internal collaboration. Second, we find that the relationships between organizational structure, engagement, and commitment make sense. But once green innovation is introduced although the results are significant; it does not guarantee that the levels of engagement and commitment will increase. However, most organizations in Thailand's heavy industry may not follow environmental regulations to provide transparent and well-structured practices for assessing green innovation opportunities.

Future research can focus on a long-term study discussing the variable change of green innovation and organizational structure in the firm's heavy industry. But before that, it is encouraged to reconfirm the possible relationship between green innovation recognition and organizational structure. The adoption of green innovation may need to test in the research framework. Moreover, other organizations' features, such as organizational design and organizational culture, will affect organizational commitment and organizational engagement. So, we suggest that future research continue discussions concerning these organizational design and organizational culture features of other organizations, thereby affecting the results in the research framework. Essentially, more research from a large sample will help confirm our findings. Further investigation should interrogate the role of organizational culture in the relationship between green innovation and organizational structure in a developing country. In particular, culture may change the supportive climate of green innovation in the firm, i.e., how that culture provides the extent to which firms can achieve environmental commitment. Furthermore, future studies should investigate the effects of other sub-dimensions (e.g., green marketing innovation) of green innovation absorption to engage in job-related attitudes and behaviors.

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