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## The Factors Affecting Innovative Behavior: An Employee Assessment System Based on Knowledge Creation

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### Abstract

Organizations thrive on the innovative behavior of their personnel, but the specific factors that influence such behavior are not widely established, especially in the Thai context. An examination of the literature reveals that the knowledge management (KM) process, which has its basis in the process of knowledge creation known as the SECI process, serves to promote innovative behavior and is a key driver of competitive advantage within innovative organizations. This research study sought to determine which factors account for success in innovation, and to establish an assessment system to evaluate employee innovation. The study sample comprised 500 employees from companies operating in the technology sector. Confirmatory factor analysis (CFA) was carried out, and an eight-factor model was formulated on the basis of the available data. The eight factors in the model were determined to have a significant influence on the success of innovative behavior observed in Thai companies. The relevant factors comprised Sharing of knowledge (SK), Self-efficacy (SE), Problem solving skills (PS), Collaboration ability (CA), Culture of innovation (CI), Organizational support (OS), Culture of learning (CL), and Executive leadership (EL). Within the organizational context, the findings reveal the statistically significant contribution of Sharing of knowledge, Culture of innovation, Organizational support, and Self-efficacy in the promotion of innovative behavior. The study results may prove helpful for organizations wishing to assess the innovative capabilities of their staff, while the success factors may be implemented within organizations through the practical application of an assessment system. Also, by filling a research gap in the literature review, this work will be beneficial to academics and researchers in order to better promote innovative behavior.

**Keywords:** Sharing of Knowledge; Self-Efficacy; Problem Solving Skills; Collaboration Ability; Culture of Innovation; Organizational Support; Culture of Learning; Executive Leadership.

## 1. Introduction

To achieve sustainable success in any industry, innovation is critical, and therefore it is necessary to promote innovative behavior among employees through development and nurturing to enhance the organizational capacity for innovation. According to Porter [1], this innovation will be crucial for successful operational outcomes. For companies operating in Thailand, especially in light of the Thailand 4.0 policy launched by the government, the aim to participate in a "value-based" and "innovation-driven" economy will compel those organizations to innovate. Their products will become more inventive rather than placing a traditional reliance on commodities. Furthermore, innovation, technology, and creativity will become the key economic drivers, and finally, it is anticipated that the service sector will eventually outpace the manufacturing sector [2].

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Innovation takes place where intelligent people apply their skills and knowledge [3] to innovative behavior, which appears in the form of novel processes and products as well as services [4]. Innovative behavior thus relies upon the application of an individual’s knowledge, positive attitude, and ability and will result in superior performance in the workplace. Further development of the required knowledge or skills is essential if a company is to benefit in the longer term. Managers also play a key role in guiding their organizations through challenging periods because they must foster the kind of creativity and innovation among personnel that will enable the company to gain a competitive advantage. Innovation will lead to novel products or procedures, and accordingly, it can be argued that innovative behavior is the effective application of the skills that are necessary for an organization to achieve stability and ultimately thrive [5].

The literature provides a number of examples of studies that examine the innovative behavior of business employees. One such study based in Thailand reported the predictive qualities of intrinsic motivation in the context of innovative behavior [6]. Other prominent works noted the significance of factors such as relational and transformational leadership, innovation trust, organizational culture, and corporate social responsibilities [7–11]. Studies have observed that the financial results of organizations can be enhanced by staff innovation [12], while quality can also be improved [13]. Innovation is positively associated with future sales and the value of the company [14], while overall performance, competitiveness, and productivity also benefit from innovative behavior [15, 16].

Organizational innovation has been widely studied [17], with increasing interest in this field in recent years, especially where it concerns employees. Approximately 60% of all papers have been published since 2012, clearly showing the growth in interest. This might also be attributed to the increasing numbers of academic publications accepting material and the growing number of institutions conducting research [18, 19]. It is anticipated that this rising trend will continue (see Figure 1).

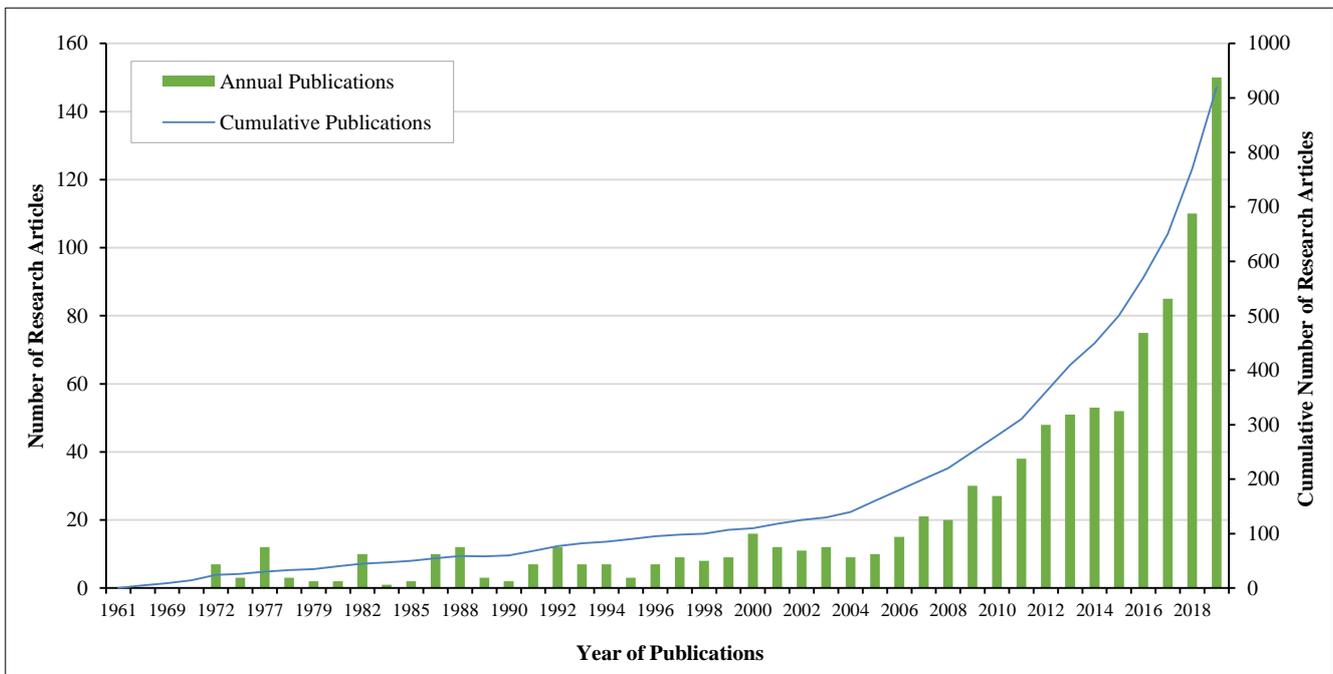


Figure 1. Publications reporting innovative activities of staff from 1961 to 2019 [20]

This study has its basis in the idea that since humans, as staff, are responsible for driving innovation, it is important to study the innovative behavior of staff. As a consequence, various economic sectors have been the focus of research into innovative behavior, with the majority being conducted in private businesses outside Thailand. Areas under investigation have included the development of innovative behavior and the evaluation of innovation performance among employees. Thailand, however, has seen no such research studies published [21]. It could be related to a lack of research as it relates to people’s skills and performance. Therefore, to minimize this gap, it is necessary to develop a system for the evaluation of innovative performance to apply in the human resources context. The aim is to foster innovative skill development in order that personnel will be able to create the advances in products and services that will lead to further economic development to the advantage of the wider society as a whole.

Having established that innovative behavior is critical for economic development, human resources management becomes a priority since organizational performance will be determined by the capabilities of employees. Innovative behavior and performance efficiency can be investigated through the application of confirmatory factor analysis (CFA) within organizations. CFA can shed light on the extent to which various contributory factors influence innovative behavior within an organization [22]. The information derived can then be applied to formulating a system to assess the performance of employees in order to subsequently develop innovative practices within that organization.

### 1.1. Research Aims

The initial aim was to determine the factors associated with successful innovative behavior and, subsequently, to apply this information in creating an assessment system to evaluate the innovative behavior and performance of employees.

## 2. Literature Review

The examination of the literature considered the integration of the various factors associated with the process of knowledge creation by using the SECI model (Socialization – Externalization – Combination – Internalization). The underlying principles of knowledge management and creation were therefore investigated where they are related to innovative behavior.

### 2.1. Knowledge Creation

Nonaka and Takeuchi [23] explained the construction of organizational knowledge, noting that competitive advantage and innovation stem from knowledge creation [24]. There are two types of fundamental knowledge: tacit knowledge and explicit knowledge. Explicit knowledge is much simpler to define and assess since it is formal, systematic, and can be conveyed as data or language. In contrast, tacit knowledge can be personal, arbitrary, and difficult to explain. In constructing the SECI framework, as shown in Figure 2, the tacit and explicit forms of knowledge are represented as pathways that demonstrate the formation and subsequent communication of knowledge.

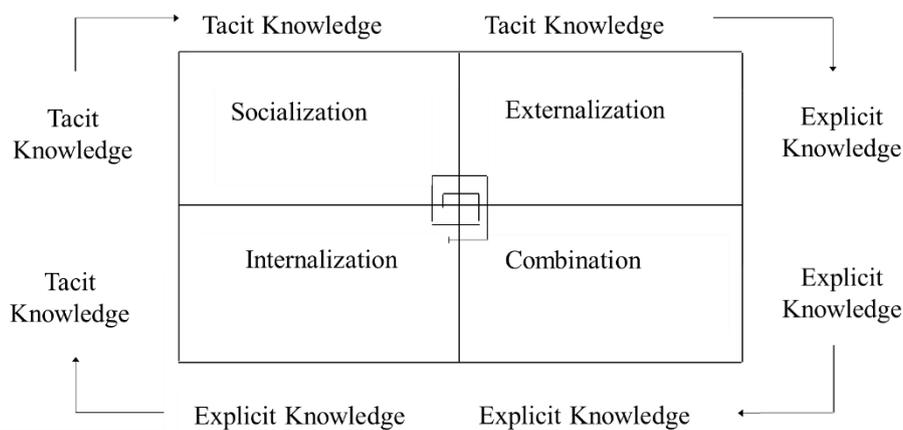


Figure 2. The SECI process [23]

The principal components of the SECI process can be described as follows: socialization describes the shift from independent tacit knowledge to group tacit knowledge; externalization describes the shift from tacit knowledge to explicit knowledge; combination describes the shift from separate explicit knowledge to systemic explicit knowledge, while internalization describes the shift from distinct explicit knowledge to systemic explicit knowledge. The SECI approach is important in this context since few other approaches have considered the way explicit and tacit knowledge are associated [25, 26].

### 2.2. Innovative Behavior

One definition of innovative behavior describes the actions of personnel in addressing a novel situation through the improvement or creation of processes or products within the organization [27]. The same authors also explained that innovative behavior provides solutions to organizational problems through enhanced service performance by seeking novel approaches to tasks, implementing new technologies, creating new work practices, or obtaining the necessary equipment required to improve performance [27]. Innovative behavior was defined by Janssen [28] as activities specifically intended to produce a desired result, whether at the individual or organizational level, while the innovative products that result should provide benefits on both societal and psychological levels, such as, for example, enhanced morale in the workplace or improvements to communicative practices, thus bringing about better organizational efficiency and performance. Interestingly, while the factors related to generating ideas, sharing these, and interacting for further development would clearly appear to support the concepts of creativity and innovative behavior, they have not commonly been the focus of researchers in the recent past [29, 30].

The articles prioritized in this study are those that have sought to list the factors that contribute to effective innovative behavior, according to the study by Rattanawichai et al. [31]. To promote innovative behavior within organizations, the selected sources were chosen on the grounds that they confirm the significance of the eight principal factors that might produce such behavior in Thai organizations. The factors in question are listed as follows: (1) Sharing of knowledge (SK); (2) Self-efficacy (SE); (3) problem-solving skills (PS); (4) Collaboration ability (CA); (5) Culture of innovation

(CI); (6) Organizational support (OS); (7) Culture of learning (CL); and (8) Executive leadership (EL). In the initial stage, factor synthesis was extended from previous studies [21, 31] and confirmed by expert interview in order to establish the key attributes of each of the selected factors, as shown in Table 1.

**Table 1. Factors related to innovative success within organizations**

Researchers	Creation of knowledge							
	Internal factors				External factors			
	Sharing of knowledge (SK)	Self-efficacy (SE)	Problem solving skills (PS)	Collaboration ability (CA)	Culture of innovation (CI)	Organizational support (OS)	Culture of learning (CL)	Executive leadership (EL)
Abukhait et al. [32]	•							
Aghdasi & Tehrani [33]				•				
Bani-Melhem et al. [34]				•				
Bednall et al. [35]	•							•
Bettencourt et al. [36]								•
Birkinshaw [37]	•			•	•	•	•	
Chatti et al. [38]	•						•	
Chen et al. [39]				•		•	•	
Dan et al. [40]		•						
Duradoni & Di Fabio [41]		•						
Eppler & Sukowski [42]	•	•				•	•	
Gavrilova & Andreeva [43]	•			•				
Hoegl & Schulze [44]						•	•	
Jeong & Shin [45]	•							
Jiang & Chen [46]	•			•				
Yli-Luoma et al. [47]	•	•		•				
Kim et al. [48]			•					
Lee et al. [49]			•				•	
Lee et al. [50]							•	
Lindlöf et al. [51]							•	
Liu & Liu [52]	•				•	•	•	
Maria Stock et al. [53]	•							•
Nazir et al. [54]				•			•	•
Nimmolrat, et al. [55]						•		
Park et al. [56]				•			•	•
Peralta et al. [57]			•					
Purc & Laguna [58]		•						
Rangus et al. [59]					•			•
Reychav et al. [60]	•							
Roffeei et al. [61]		•			•		•	
Schulze & Hoegl [62]	•	•	•		•	•	•	
Shang et al. [63]	•			•			•	
Shankar et al. [4]	•		•			•	•	
Shouxian & Peng [64]		•	•	•				
Sofianti et al. [65]			•					
Uotila et al. [66]	•	•			•	•	•	
Vaccaroa et al. [67]	•		•	•		•		
Wang & Hu [68]				•		•		
Wu & Wang [69]	•			•				
Zhang & Hou [70]	•			•				•
Zhu et al. [71]				•				
Expert interview	•	•	•	•	•	•	•	•
<b>Total</b>	20	10	9	17	7	12	17	8

Note: Selections were based upon the frequency of factor appearances, while considering the importance of similar statements

### 3.2.1. Sharing of Knowledge (SK)

The sharing of knowledge describes how information is conveyed from one party to another, thus allowing a shared understanding to develop or new insights to be formed. From earlier research, it is apparent that the sharing of knowledge leads to staff empowerment and ultimately promotes innovative behavior [32].

### 3.2.2 Self-Efficacy (SE)

Self-efficacy can be explained as the capacity for an individual to express themselves and act in an independent manner to address their problems. Where empowered individuals exhibit self-efficacy, innovative behavior can be supported [61].

### 3.2.3 Problem Solving Skills (PS)

Problem-solving skills encompass the ability to devise more than one approach to resolve challenging situations or to be able to respond in a timely manner to address urgent problems. In particular, the capacity for situational analysis allows a problem solver to understand the limitations associated with their assigned duties, enabling them to create alternative plans to anticipate likely problems in the future. Earlier research has indicated that innovative behavior is strongly affected by the ability to solve problems [48].

### 3.2.4 Collaboration Ability (CA)

For organizational goals to be accomplished, individuals must be willing to cooperate with other team members in collaborative working practices. Such collaborative working environments can in turn foster innovative behavior as ideas can be discussed and employees can openly discuss potential improvements [34, 72].

### 3.2.5. Culture of Innovation (CI)

Companies that foster a culture of innovation will actively encourage opinions to be shared, thus promoting trust and freedom and allowing employees to take responsibility for their work and futures. In such an environment, innovative behavior is more likely to be observed, and innovative practices will flourish [61].

### 3.2.6. Organizational Support (OS)

The working environment within an organization must be generally supportive to promote the development and implementation of new ideas and to provide employees with rewards and recognition when innovative and creative ideas are produced [44, 73].

### 3.2.7. Culture of Learning (CL)

A culture that fosters learning typically promotes knowledge sharing and collaboration, which can help improve the skills and knowledge of all employees throughout the organization. Training offers one means of achieving a learning culture. It was argued by Nazir et al. [54] that innovative behavior from employees is more likely under a culture of learning, although affective commitment may not be similarly influenced.

### 3.2.8. Executive Leadership (EL)

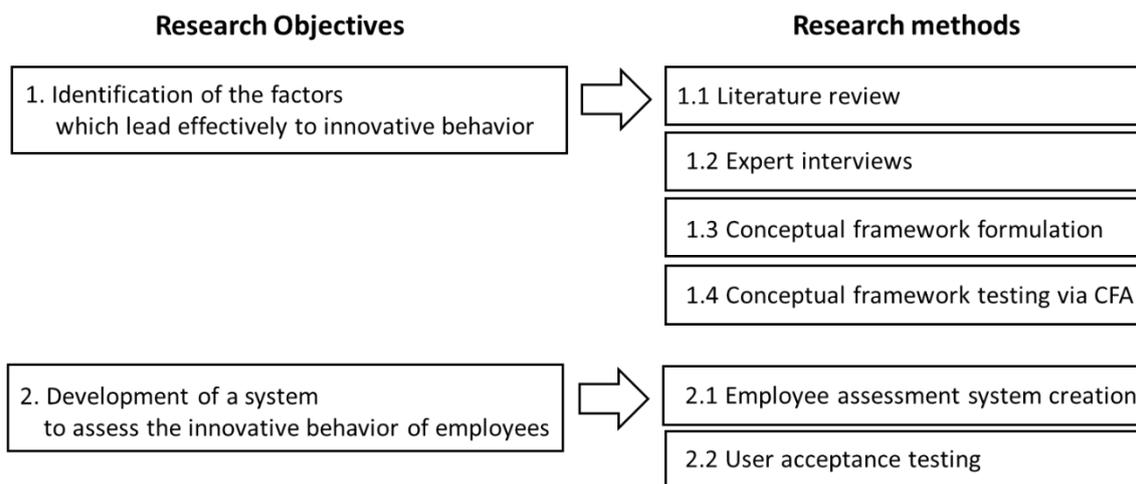
The achievement of organizational objectives relies upon executive leadership, which involves establishing the trust of employees and supporting them to deliver creativity and innovation. Previous studies have demonstrated that transformational leadership is positively associated with innovative behavior [54].

### 3.2.9. Innovative Behavior (IB)

In the context of this research, innovative behavior is held to be the actions of staff in producing and acting upon novel ideas that are used to create new products, work methods, or services. Typical actions include problem solving, the development and improvement of existing ideas and practices, the creation of new procedures, products, or materials, and adding value to the current products or services.

## 3. Research Methodology

This study was conducted through an initial review of the relevant literature, followed by a series of expert interviews. The findings were used to create the conceptual framework, which was then analyzed via confirmatory factor analysis (CFA). They were reported in the earlier papers [21, 31]. The assessment system for employee innovation was then implemented, and a user acceptance test was carried out. Figure 3 sets out the research design and techniques applied in this research. In order to clearly discuss the development of the system to assess the innovative behavior of employees in later sections, the results of this study reported in the mentioned earlier papers were drawn in Section 5.



**Figure 3. An overview of the research methodology applied**

### 3.1. Study Participants

A multistage sampling approach reflecting the business hierarchy was employed to select the 500 sample members from technology sector companies who participated in this research. All participants provided their informed written consent before continuing in the study. The participants were drawn at random from a list of suitable companies and taken from the various specific business units. CFA was applied to provide an appropriate sample size guideline using a simple formula based on the construct size and the number of structural paths, which in this case amounted to  $10 \times 28 = 280$  [74]. Since the study eventually used 500 participants, this was clearly an adequate number.

### 3.2. Procedure

The study employed a mixed-methods approach comprising both quantitative and qualitative techniques [75]. In the qualitative component, interviews were conducted with experts who were able to ensure the validity of the key attributes for each factor drawn from the review of the literature and a quantitative survey. Initially, the literature was examined in order to identify factors typically associated with successful innovative behavior. These factors were subsequently verified through interviews with experts in the field to create the conceptual framework. A questionnaire was then formulated in order to determine the perceptions of the respondents with regard to the importance of the various factors involved. There were 28 items in total, and the format employed a 5-point Likert scale (1 = least important, 5 = most important) to assess the perceptions of: (1) Sharing of knowledge (SK); (2) Self-efficacy (SE); (3) Problem solving skills (PS); (4) Collaboration ability (CA); (5) Culture of innovation (CI); (6) Organizational support (OS); (7) Culture of learning (CL); and (8) Executive leadership (EL). CFA was then performed with LISREL to investigate the structure of the contextual factors. In the last stage, the system for employee assessment for innovative behavior was produced and tested.

## 4. Results

### 4.1. Expert Interviews

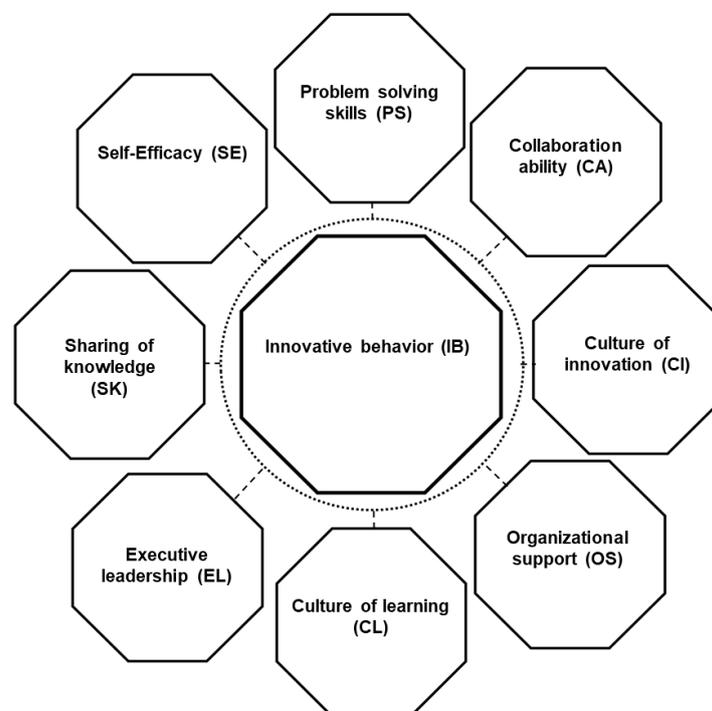
A total of six experts were invited to participate, all of whom offered no fewer than 20 years of human resources management experience. The data and insights obtained from the literature were extensively considered in collaboration with the expert reviewers to determine the meanings of specific units related to various themes so that the conceptual framework content could be developed to accurately represent the prominent perspectives reported. These results were duly verified by the panel of experts, ensuring their validity and reliability. Table 2 summarizes the findings from the interviews with the experts in human resources management.

### 4.2. Conceptual Framework

The factors associated with innovative behavior were analyzed and discussed through the review of the literature and the expert interviews. According to earlier studies, Sharing of knowledge (SK), (2) Self-efficacy (SE), (3) Problem solving skills (PS), (4) Collaboration ability (CA), (5) Culture of innovation (CI), (6) Organizational support (OS), (7) Culture of learning (CL), and (8) Executive leadership (EL) exhibit a strong correlation with innovative behavior. Studies have confirmed that collaborative abilities and organizational support have a close correlation with innovative behavior, while the sharing of knowledge is another influential factor. The conceptual framework that describes the factors related to innovative behavior can be seen in Figure 4.

**Table 2. Findings from the expert interviews [31]**

Expert	Results from expert interviews
X1	<ul style="list-style-type: none"> <li>Inclusive team building is a strategy which organizations should implement in order to allow new ideas to be expressed and shared.</li> <li>Significant restrictions come in larger organizations, which often impose barriers in blocking opinions, thus limiting the potential for innovation.</li> </ul>
X2	<ul style="list-style-type: none"> <li>Leadership is an important human element, because someone must encourage the others to think freely to create ideas so that collaboration can then take place.</li> <li>Desirable personal qualities include an eagerness to learn, resilience, the ability to think outside the box, and an open-minded and results-oriented nature.</li> </ul>
X3	<ul style="list-style-type: none"> <li>Results should be evaluated and monitored systematically via the use of IT.</li> <li>Innovative ideas might be the result of organizational goals, or they can be created by employees who could be conducting projects or attempting to solve problems. To promote innovation, organizations should incentivize the process and simultaneously provide practical support.</li> </ul>
X4	<ul style="list-style-type: none"> <li>To assess innovative behavior, the tool used should assess the outcomes in terms of ideas or suggestions which have the potential for further development.</li> <li>Innovative behavior involves staff thinking in novel ways and presenting new opinions. It requires teamwork and a desire to solve problems together.</li> </ul>
X5	<ul style="list-style-type: none"> <li>Innovation is unlikely to occur when individuals neither share nor accept novel opinions.</li> <li>Due to the rapid pace of innovative change in business, employees must be open to novel ideas and capable of acting with flexibility.</li> <li>The barriers to innovative behavior in organizations are often caused by small and medium-sized organizations with own management. There is a conflict of interest between the shareholders. It is a defense of their own interest causing to not listen to others in the organization who see flaws and try to change</li> </ul>
X6	<ul style="list-style-type: none"> <li>The workplace atmosphere has a strong influence upon innovative behavior, while working assignments and time management are also important factors.</li> <li>The principal barriers preventing innovation include a failure to accept alternative viewpoints, rigid application of rules and frameworks, and the absence of corporate level support.</li> <li>In addition, co-operation affects innovation, along with the ability to tolerate and thrive when the working or market environment becomes increasingly dynamic.</li> <li>Changes in company policies can obstruct innovative behavior.</li> </ul>



**Figure 4. Conceptual framework [31]**

**4.3. Confirmatory Factor Analysis (CFA)**

CFA was conducted on the basis of the maximum-likelihood estimation approach with LISREL (linear structural relations) so that the factor structure could be confirmed. Chi-square values were used as a measure of goodness of fit for the model. The tested and independent models were compared to the saturated model ( $\chi^2/df$ ), with measures including

goodness of fit index (GFI), comparative fit indices (CFI), adjusted goodness of fit index (AGFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). A model showing good fit would be expected to exhibit  $\chi^2/df$  values below 2.00, GFI values above 0.95, CFI values exceeding 0.95, AFGI values above 0.90, RMSEA values below 0.05, and SRMR values also below 0.05 [76, 77]. Table 3 presents these results, indicating acceptable findings for a good fit:  $\chi^2/df = 1.140$ , GFI = 0.960, CFI = 1.000, AGFI = 0.940, RMSEA = 0.017, SRMR = 0.082.

Table 3. Model fit indices [21]

Model fit indices	Recommended values of acceptable fit	Model fit summary	Evaluation result
$\chi^2/df$	< 2.00	1.140	Pass
CFI	> 0.95	1.000	Pass
GFI	> 0.95	0.960	Pass
AGFI	> 0.90	0.940	Pass
RMSEA	< 0.05	0.017	Pass
SRMR	< 0.05	0.082	Pass

According to the results from the confirmatory factor analysis, this eight-factor model was suitable to be applied in the context of innovative behavior promotion in Thai organizations.

The eight-factor CFA model is shown in Figure 5. The lowest factor loadings were attributed to collaborative ability (CA) and culture of learning (CL) at 0.16, while the highest loading was for sharing of knowledge (SK) at 0.99. Sharing of knowledge (SK) could be considered the best indicator of organizational innovation behavior support, closely followed by organizational support (OS), then culture of innovation (CI), collaborative ability (CA), and culture of learning (CL), respectively, although the latter had limited influence on innovative behavior.

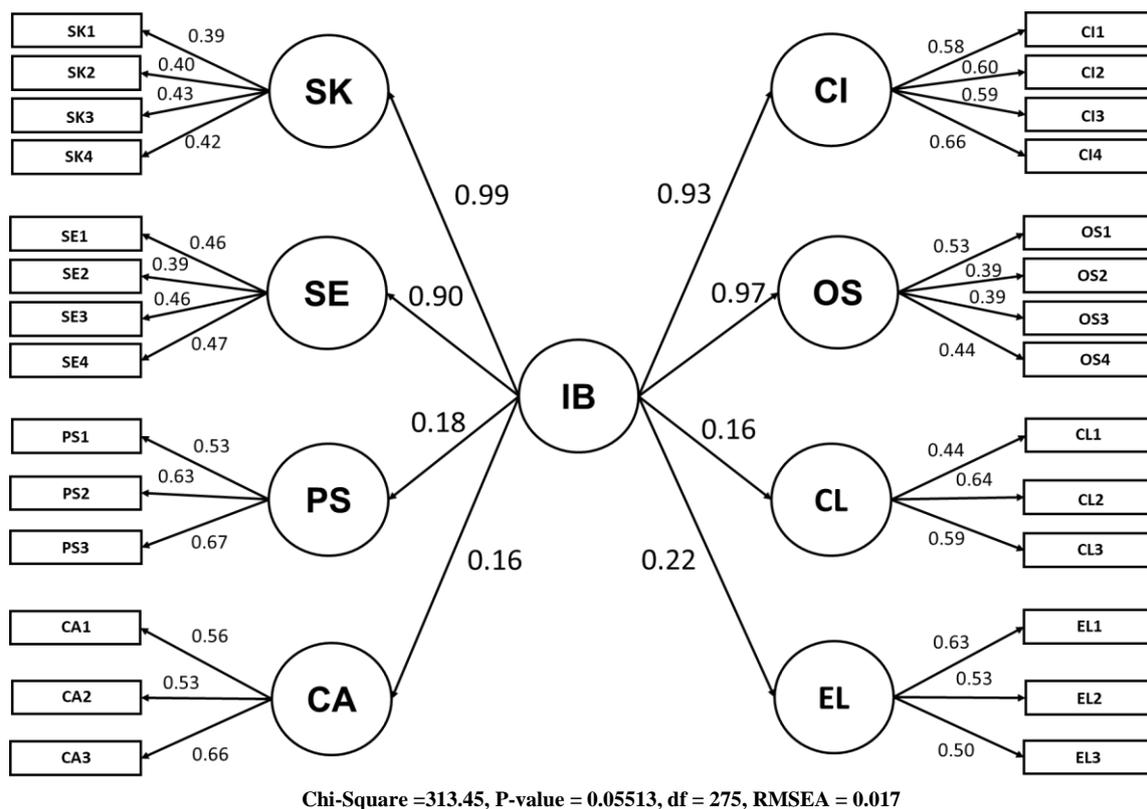


Figure 5. The CFA eight-factor model for the promotion of organizational innovative behavior [21]

On the basis of the data gathered via the survey, the eight-factor model was confirmed to be a good fit. The most influential of the factors was sharing knowledge (SK), while innovative behavior was less likely to be encouraged by factors such as collaborative ability (CA) and a culture of learning (CL). This research addresses the success factor of innovative behavior in Thailand. The findings indicate that participants from technology sector companies have a high degree of SK, SE, CI, and OS. Thus, companies must address these challenges by developing talent to serve as the primary organizational competency to achieve their goals. This is in line with several researchers who studied the factors influencing innovative behavior in organizations [62, 66].

## 5. Implications

### 5.1. Assessment System

The CFA findings were used to formulate the system for employee assessment. The system comprises two modules that are fully integrated. The first encompasses the assessment questions, while the second is the assessment report, which is provided along with further guidance. Under this system, data can be collected and presented in statistical format, along with a detailed results summary. As per Figure 6, The assessment system was configured from CFA factors containing SK with 0.99 factor loading, SE with 0.90 factor loading, PS with 0.18 factor loading, CA with 0.16 factor loading, CI with 0.93 factor loading, OS with 0.97 factor loading, CL with 0.16 factor loading, and EL with 0.22 factor loading. The assessment of innovative behavior was organized into each question based on factor loading. Administrators can create a report as per the user's requirements. Also, users performed evaluations in the systems for each factor and viewed the outcomes and suggestions on the dashboard.

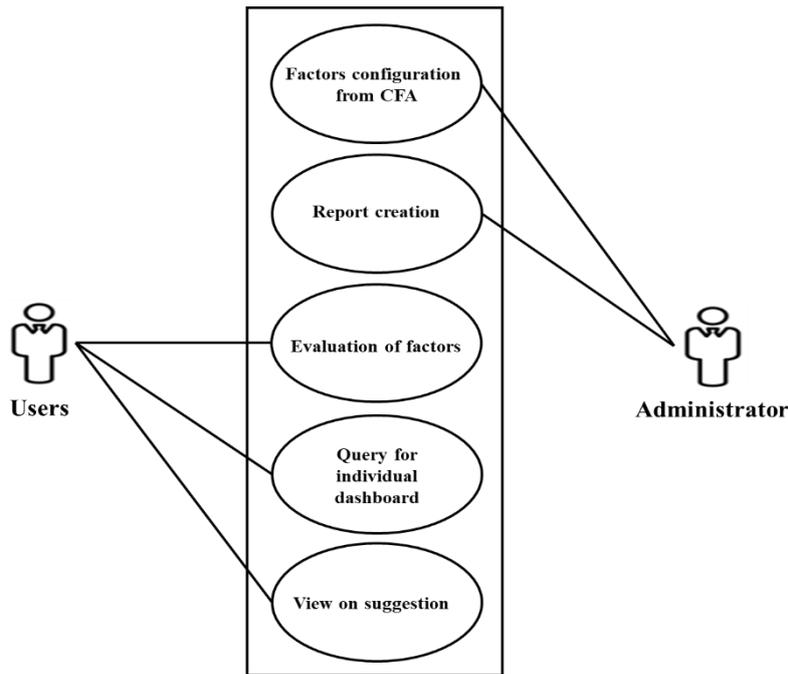


Figure 6. Use case diagram

Screenshots of the system can be seen in Figure 7. The system itself will be accessible via the cloud. Thai language is used in the system as it is aimed to be used in organizations in Thailand. This assessment system will provide valuable support to those organizations interested in conducting skills assessments of their employees in the area of innovative behavior. It is useful to human resource management because it can be used as staff evaluation to know their level of innovation capability in order to provide the training program, individual development, and also recruitment.

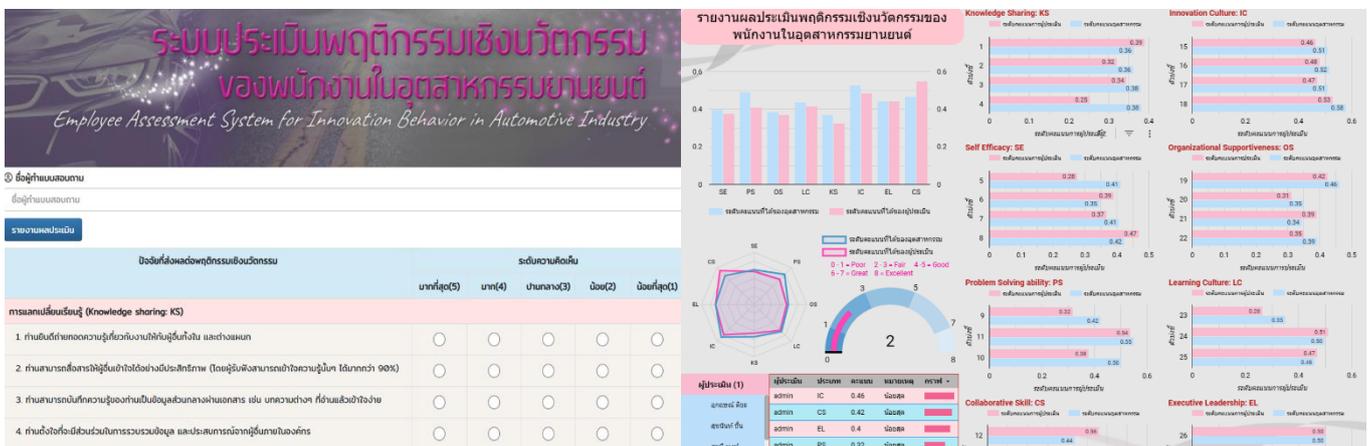


Figure 7. System of employee evaluation

## 5.2. Evaluation of the System

With the system ready for implementation, its suitability was evaluated in a practical context, with a sample of 30 participants who had at least two years of working experience. The scoring system for perspectives with regard to user acceptance of the system for employee assessment comprised five levels: 1 = very low to 5 = very high. The acceptance of the system was rated overall at a high level, with a mean score of 4.63 (Table 4).

**Table 4. User acceptance assessment**

Subject	Mean ( $\bar{x}$ )	Acceptance level
1. Performance of the system (accuracy, speed, comprehensiveness, quality of design, etc.)	4.46	high
2. Ease of use (ease of comprehension, clarity of reports, etc.)	4.68	high
3. Benefits (in contrast to the existing procedure)	4.57	high
4. Usage intention (willingness to use and recommend to others)	4.42	high
Overall system score	4.63	high

## 6. Discussion

From the expert interviews, one consistent finding was that it is important to foster innovative behavior by encouraging the sharing and acceptance of new ideas and by building teams to create trust. This finding was in concurrence with the studies of Leroy et al. [78] and Roye [79]. In large organizations, however, it can often be difficult to create an environment where ideas can be freely expressed and creativity can flourish. Inconsistency in communication can be a significant obstacle to innovation. Accordingly, the model must incorporate the personal components of knowledge sharing and collaboration ability if staff members are to work effectively together to innovate. Similar findings were reported by Birkinshaw [37], Wu & Wang [69], Vaccaroa et al. [67], Shang et al. [63], and Gavrilova and Andreeva [43]. Meanwhile, it was strongly argued by Zhang & Hou [70] that it was essential to create novel ideas prior to developing new products. This would be followed by collaborative work to share the necessary knowledge through shared experiences and social interaction, often via training sessions and practical seminars [55]. Under the SECI model, this would represent the socialization phase, followed by analysis of market opportunities, competition, and demand [4, 80]. The design process is complex because the creation of novel products can only be carried out when the market potential and customer demands are understood and the technical requirements are available.

The skills and knowledge of the staff are crucial, with problem solving and self-efficacy to the fore, as noted previously by Schulze & Hoegl [62] and Shouxian & Peng [64]. For data to be transformed into useful knowledge, employees must cooperate, share ideas, be open to new ways of thinking, and sometimes be willing to learn from failure [81]. The SECI process demands conceptual clarity through documentation, especially in the externalization stage. Followed by knowledge consolidation in the combination stage. This serves to prepare that knowledge for an analysis of feasibility so that management can determine whether approval can be granted. Further improvements can then be made during an evaluation process that delivers feedback to team members, which is the internalization stage of the SECI process. Executive leadership is therefore also critical because team members must be persuaded and encouraged to collaborate in generating creative and innovative ideas [35, 54, 56, 70]. The working environment within an organization must promote employee interaction so that staff will collaborate to accomplish shared objectives. A learning culture will be important, along with management support and the provision of a suitable space in which to interact. Other researchers have reported similar findings [37, 52]. The development of a suitable working environment can be achieved via the provision of rewards and by motivating employees to implement their ideas. Furthermore, corporate policies must explicitly promote innovation through fostering a corporate culture that emphasizes opinion sharing, expression of ideas, cooperative thinking, and collaborative problem solving.

On the basis of the expert interviews, the factors identified as contributing to innovative behavior may be further classified into eight factors, the first four of which can be considered personal components: Sharing of knowledge (SK), Self-efficacy (SE), Problem solving skills (PS), and Collaboration ability (CA). The remaining four can be considered environmental components: Culture of innovation (CI), Organizational support (OS), Culture of learning (CL), and Executive leadership (EL). These factors find support in the review of the literature concerning those elements that promote organizational innovative behavior among personnel. The use of CFA allowed the creation of an innovative behavior model, whereupon analysis of the empirical data confirmed the suitability of the structural equation model for this innovative behavior model. Accordingly, it can be inferred that innovative behavior among employees can be accurately predicted by the factors employed in the model.

From this research, it is clear that the selected factors all have a significant role to play in organizations operating in Thailand. Similarly, the selected factors have been shown to be important in other parts of the world [82, 83], especially when considering certain individual and environmental components of the model. For innovative behavior to take place, both of those human and environmental components are necessary [84], but the study also confirms that the various

factors do not have equal influence. Accordingly, the study reveals the differences in the level of influence exerted by each factor, which in turn allows managers to adjust their approaches to ensure that innovate behaviors are allowed to flourish. The most influential factor is learning exchange ( $\beta=0.99$ ), followed by organizational support ( $\beta=0.97$ ), the environment of the workplace ( $\beta=0.93$ ), and finally self-efficacy ( $\beta=0.90$ ). Each of these showed statistical significance in contributing to innovative behavior. Within the organizational context, it can therefore be stated that self-efficacy and the sharing of knowledge, which relate to the individual, along with the working environment and organizational support, will serve to promote innovative behavior.

When the developed assessment system for the innovative behavior of employees was examined, the user acceptance level was high for those personnel working in the automotive sector ( $\bar{x} = 4.63$ ). This system is able to recognize both the potential and the current level of competence of the employees in terms of innovative behavior and can therefore be used as a means of supporting strategies for staff, thus leading to an increase in innovative practices within an organization. It was found that for each of the various evaluation items, the user acceptance level was high: ease of use ( $\bar{x} = 4.68$ ); original technology advantages ( $\bar{x} = 4.57$ ); system efficiency and benefits ( $\bar{x} = 4.46$ ), and usage intention ( $\bar{x} = 4.42$ ). These findings matched the work of Vaccaroa et al. [67], whose study found that where systematic collaboration takes place, innovative goals can be accomplished. This would appear to confirm that the developed assessment system is suitable for practical applications.

## 7. Conclusion

This study was to identify the factors affecting innovative behavior and confirm the structural dimensions. The results of Confirmatory Factor Analysis (CFA) were used to implement the assessment system. The results from this study provide valuable insights that may be applied to promote innovative behavioral practices in Thai companies. The factors employed in the study as predictors of innovative behavior were all shown to be relevant in the Thai context, and the findings also concur with those of earlier researchers experimenting in other parts of the world [82, 83]. Internal factors comprise Sharing of knowledge (SK), Self-efficacy (SE), Problem solving skills (PS), and Collaboration ability (CA), while external factors comprise Culture of innovation (CI), Organizational support (OS), Culture of learning (CL), and Executive leadership (EL). These factors, drawn from the review of the literature, confirm that both internal and external elements are responsible for shaping the development of individuals towards innovative behavior [84]. However, it is apparent that not all factors are equal in terms of their influence. It is therefore important to understand the relative importance of the factors concerned as well as the effects of the different factors upon innovative behavior when interacting in combination. This will allow managers to create a working environment that is more conducive to innovation.

The most statistically significant influencers of innovative behavior were the Sharing of knowledge (SK:  $\beta=0.99$ ), Organizational support (OS:  $\beta=0.97$ ), Culture of innovation (CI:  $\beta=0.93$ ), and Self-efficacy (SE:  $\beta=0.90$ ). It is therefore clear that the innovative behavior of an individual will be shaped by both external and internal factors. For organizations wishing to promote innovation, the research assessment system offers a means of determining the extent to which their management practices are effective. It will allow more effective training to be implemented, a more effective workplace environment to be created, and more effective recruitment practices to be followed, thus developing staff who are capable of innovating and bringing about economic benefits and a clear competitive advantage.

## 8. Declarations

### 8.1. Author Contributions

Conceptualization, N.R., M.W., and J.K.; methodology, N.R., M.W., and J.K.; software, N.R.; validation, N.R., M.W., and J.K.; formal analysis, N.R., M.W., and J.K.; investigation, N.R., M.W., and J.K.; resources, N.R.; data curation, N.R.; writing—original draft preparation, N.R., M.W., and J.K.; writing—review and editing, N.R., M.W., and J.K.; visualization, N.R.; supervision, M.W., and J.K.; project administration, N.R. All authors have read and agreed to the published version of the manuscript.

### 8.2. Data Availability Statement

The data presented in this study are available in the article.

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### 8.5. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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