The Antecedent Factors Product Innovation, Process Innovation and Firm Performance of Listed Companies in the Stock Exchange of Thailand

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Abstract

The purpose of this research is to study the antecedent factors product innovation, process innovation and firm performance of Listed Companies in the Stock Exchange of Thailand. This study used structured questionnaire and analyzed data gathered from 251 employees of Listed Companies in the Stock Exchange of Thailand by using stratified sampling technique and hypotheses verified through Structural Equations Modelling (SEM).

The findings indicate that both product and process innovation have a strong and positive association with firm performance. Furthermore, antecedents such as customer focus, organizational learning capability and creative capability have significant impact on product innovation and positive impact on process innovation. The results of this study could be used by any managers of Listed Companies in the Stock Exchange of Thailand to improve successful innovation projects. The results also provide companies operating in Listed Companies in the Stock Exchange of Thailand with useful information on how their policies and actions might affect their firm innovation.

Keywords: Customer Focus, Organizational learning capability, Creative capability
Process innovation, Product innovation, Firm performance

1. Introduction

Business environment is rapidly changing and competitiveness is increasing. It is important for corporates to keep adjusting their strategy to maintain their competitive advantage. Executives of most successful corporates put emphasis on developing their workplaces into innovative corporates to apply new knowledge and ideas to their products and services (Chutiwong and Kertsri, 2011). Innovation is a key success factor (Zehir, Can, and Karaboga, 2015). Therefore, innovative capability is one of the key strategic approaches for corporates and business to develop efficient innovation to improve their competitiveness and achieve sustainable success in a long run. This directly boosts up the corporate profits (Micheels, 2010; Gunday et al., 2011), customer focus, sustainable competitiveness, and value-added for current and future customers (Narver and Slater, 1990). Organizational learning cap is one of the concepts about organizational knowledge and organizational learning. This concept views that corporate should establish proper knowledge management and be aware of mutual learning development to become the corporate of learning and creative capability, creating new innovation which leads to practice and advancements (Vicari, 1998).

Developing an innovative business is critical for running a business today. Innovation business is an alternative corporate innovation management to transform the characteristics or behavior of the corporate that have not been changed before to satisfy the stimuli of the globalization context with knowledge and innovation as the key to add the value to the product and service to achieve customer demand and satisfaction. If a corporate could not keep up with new changes, it would be difficult for the corporate to thrive in a long term, especially when the success of the leading business relies upon presenting a form of innovation such as products or process. In general, the ultimate objective is for the survival and competitiveness of the corporate in the free market. This open opportunities for business in Thailand to grow through innovations.

Furthermore, when innovation is taken into practice, it is important to assess corporate performance to determine how successful it is or how far it needs to go to achieve the goal. This
will enable corporates to know whether the process is still in control and efficient as desired and is able to identify their strengths and weaknesses. Nonetheless, different corporates have different success factors. There are several ways to measure a corporate’s need to improve their sales and growth, benefit, and marketing strategy, understanding its potentials for development to survive and stabilize its operation while some criteria might aim merely to measure financial performance.

Substantially, innovations will help businesses grow and evaluate their performance, so to create an innovation, it is divided and limited by two factors: product and process. The literatures in this study include factors in innovation, types of innovation, and their interrelationships. Therefore, this study focuses on the gap in literatures, especially the separation between product and process innovation and consideration of innovation literatures. Therefore, the research questions (RQ) have been set to satisfy the scope and objective as follows:

RQ1: What are the existing factors that have positive impact on the product and process innovations?
RQ2: Do product and process innovations lead to positive perception?

2. Literature Review

2.1 Product innovation (PRO_INN)

Product innovation is the development of new products and services or improving the existing products and services, either in terms of technique, components, and software to be more user-friendly or other features. It is closely related to the introduction of a new product or the improvement of the existing product (Chang et al., 2012; Polder et al., 2010). Product innovation may include changes in design that, in turn, cause significant changes in product usability or features (OECD, 2005). The main purposes of product innovation in an organization are to increase product delivery value and achieve higher levels of efficiency (Polder et al., 2010). In addition, product innovation can make use of new or existing technology and (Gunday et al., 2011).

In general, product innovation is considered a difficult process because it is driven by changing customer needs, technological advances, increasing international competition, and reducing product life cycle (Gunday et al., 2011). Product innovation is a continuous and interdisciplinary process and integrates many different capabilities inside and outside of the organization. It enables manufacturers to maintain their product line to be competitive and to gain an advantage in the competition (Ottenbacher and Harrington, 2009). Despite the advantages of all product innovations, it is still a risky and expensive effort because the results show low success rates and many projects are ending halfway in the development cycle (Cormican and O’Sullivan, 2004). To successfully achieve organizational goals, product innovation should have important interactions within the organization as well as customers and suppliers (Gunday et al., 2011).

Businesses that use responsive marketing planning often try to think about the needs of customers in their market or group. Therefore, they try to improve their products or services through innovation (Li et al., 2008). From the perspective of data processing, high emphasis on customer enables the corporate to obtain additional data about the change of the market. These data will drive the business to achieve successful innovation (Zhang and Duan, 2010). Furthermore, responsive planning gives opportunity to be earn the credibility by the use of data and prediction to search for data and reduce complication of data usage in developing a new product (Atuahene-Gima et al., 2005).

2.2 Process innovation (PRE_INN)

Recently, innovation gained many attentions from businesses (Trott and Hartmann, 2009; Van De Vrande et al., 2010; Lichtenhaler, 2011). It has been considered as the application of the new production or improvement or delivery that satisfies the change in technical equipment and software.
Process innovation is the modification of approaches or methods in improving or delivering the product, including technical equipment and devices. It increases efficiency and effectiveness of the activity to improve productivity and lower the cost of production per unit (Abdallah and Phan, 2007).

Process innovation is related to the improvement in production, logistics, as well as other activities including accounting, purchase, and maintenance (Polder et al., 2010). It aims to produce innovative products and new products (Hassan et al., 2013). This might require some new method that has not been used before (Polder et al., 2010). Damanpour (2010) indicated two key steps of process innovation, including the beginning and the implementation. He affirmed that the beginning concerns something called “opening toward innovation” determined by the willingness of the members of the organization to use or to oppose the innovation. Latest literatures confirm the importance of the steps of process innovation and reevaluate their values (Lendel et al., 2015). These procedures include identifying customers’ needs and opportunity to create innovation, explore new ideas, modify, distribute, and developing them (Hansen and Birkinshaw, 2007; Laursen and Salter, 2006; Bernstein and Singh, 2006). In other words, it is a strong combination between internal and extern sources to achieve a better outcome (Krishnan and Jha, 2011).

2.3 Customer Focus (CFF)

While the economy is becoming more market-based, customer focus has become more significant than ever. With strong customer focus, it is possible to predict the current and underlying customers’ needs (Paladino, 2008). Bastic and Leskovar-Spacapan (2006) claimed that customers place strong emphasis on “collecting data about target customers’ need and competitors’ competitiveness” continuously and “the use of these data to create higher customer value”. Therefore, customer focus refers to the process by which the organization uses to establish customer relations that highlight the satisfaction of customer needs. To embrace the concept of customer focus is to receive customer needs at the present and in the future. Also, strong customer focus might lead to the focus on the innovation derived from the needs that can be adapted to customers’ need constantly (Santos-Vijande and Alvarez-Gonzalez, 2007). Although it is evident that the presentation of innovation is an internal process, external factors, especially customers, also play an important role in the distribution and acceptance of the innovation.

The purpose is to deliver product innovation to the customers or end users with the most efficient way (Capon et al., 1992; Ettlit and Reza, 1992; Gopalakrishnan and Damanpour, 1997). Although product innovation can be seen more clearly, process innovation is also crucial to guarantee business competitiveness (Schilling, 2008). Most of the process innovation focuses on the quality control and efficiency improvement, continuous production or related processes in the system, namely inputs, process, and outputs (Abernathy and Utterback, 1978; Tushman and Nadler, 1986; Gopalakrishnan et al., 1999; Damanpour and Gopalakrishnan, 2001) Therefore, our hypothesis is that:

**H1**: The customer focus has a direct positive effect on product innovation.

**H2**: The customer focus has a direct positive effect on process innovation.

2.4 Organizational learning capability (OLCC)

The learning organization appears to be an important competence for all organizations to develop to succeed. In fact, some researchers cite the learning organization as the only sustainable competitive advantage in response to an increasingly unpredictable and uncontrolled business environment (Weldy and Gillis, 2010). Due to the crucial importance of organizational learning capability in the current dynamic and competitive environment, it is critical to find a valid measure to assess organizational learning capability in firms. This measurement not only assists managers to
understand which factors affect organizational learning capability. but also help them to evaluate the value of their firms.

Organizational learning capability is the concept of organizational development focusing on developing the system of learning leadership and team learning to encourage knowledge, experience, and skill sharing, and ultimately, continuous development that contribute to adaptation to changes and higher competitiveness. A study by Crossan and Berdrow (2003) reveals that higher organizational learning capability will lead to constant corporate capacity development. Kuo (2011) also discovers that organizational learning capability clearly influences organizational innovation capability. It could be concluded that empirical learning capability is a key factor for development and constantly improved capability. Thus, the hypothesis is that:

**H3:** The organizational learning capability has a direct positive effect on product innovation.

**H4:** The organizational learning capability has a direct positive effect on process innovation.

### 2.5 Creative capability (CCC)

As a whole, creative capability refers to developing new ideas or products or services depending on the manner of observation and relationship (Scozzi et al., 2005). Notably, generating new and useful ideas in any dimension is one of the significant parts of process innovation (Mathisen et al., 2004). Carayannis and Gonzalez (2003) state that creativity for any individuals is the necessary factor to create innovation. In addition, Gumusluoglu and Ilsev (2009) mention that creativity at individual level through new ideas and implementation is likely to lead to improved innovation product efficiency. In fact, creativity is the purpose of developing innovation.

Often time, many researchers refer creativity as an innovation and presentation. Lee et al. (2007) develops the circle of creativity-innovation which displayed how an organization can promote employees’ creativity by hiring creative personnel to inspire them and create a working environment that enhances creativity. Mathisen et al. (2004) say that the team atmosphere is the indicator for the innovation responsible by the group. Junarsin (2010) says that the emphasis on internal creativity is one of the key strategies to upgrade service innovation management. A survey by Gumusluoglu and Ilsev (2009) conducted with 163 participants who were R&D personnel and managers at small Turkish software development firms indicate that creativity is positively related to innovation of the organization. It can be concluded that creativity capacity influences product and process innovation.

Therefore, the hypothesis is that:

**H5:** The creative capability has a direct positive effect on product innovation.

**H6:** The creative capability has a direct positive effect on process innovation.

### 2.6 Firm performance (FPP)

Firm performance is a multidimensional term and it can ben referred to manufacturing and marketing (Sohn et al., 2007), or conclusion, as growth and profit of firms (Wolff and Pett, 2006). In keeping with previous definitions of performance (Carayannis and Gonzalez, 2003; Weber and Weber, 2007) and the present objective, firm performance is define as the organizational performance of firms in terms of sales, profitability, and market share instead of accounting-based performance measures, such as ROA, ROS, and ROI. Previous studies reveal that managers in emerging markets like Turkey are sensitive to long-term growth strategy and market expansion (Hitt, 1995). In this study, the companies with innovation cap adapt to changes in the market better and can make a decision faster, and therefore, will have better performance (Garcia-Morales et al., 2007).

According to Mone et al. (1998), the ability to create innovation is a key efficiency indicator of a business, consequently, firm innovation capability is an important part of the firm performance.
Newer innovation usually has higher efficiency than the original. A study in Turkish industry by Erdil and Kitapc (2007) points out that innovation influences business efficiency and there is a positive relationship between innovation and business efficiency. Furthermore, innovative firms should have higher performance than non-innovative firms (Cozzarin, 2004). Therefore, a substantial number of academics have researched the interactions between innovation and Firm performance. The results of this study suggested that firm innovativeness effects Firm performance. Therefore, the hypothesis is that:

\[ H7: \text{The product innovation is directly positively associated with firm performance.} \]

\[ H8: \text{The process innovation is directly positively associated with firm performance.} \]

3. Research Method

3.1 Final survey sample Size

This study surveyed 793 companies listed in SET from 8 industries, with exceptions for those that fail to conform to the standards or those being withdrawn due to unclear identification of industry and those in the group of MAI. These industries are Argo and Food Industry, Consumer Products, Financials, Industrials, Property and Construction, Resources, Services and Technology. Companies in each group were randomly sampled from the population. Data are referenced from the website of the Stock Exchange of Thailand (SET) as of 2nd January 2020, with exception for those under recovery and MAI companies which are companies operate specialized businesses.

The sample population and companies listed on the SET; the company is divided into eight sectors. The research sample was divided into a total of 793 companies. The industry groups and business groups as the following:

<table>
<thead>
<tr>
<th>Industry group</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argo and Food Industry</td>
<td>68</td>
</tr>
<tr>
<td>Consumer Products</td>
<td>51</td>
</tr>
<tr>
<td>Financials</td>
<td>71</td>
</tr>
<tr>
<td>Industrials</td>
<td>132</td>
</tr>
<tr>
<td>Property and Construction</td>
<td>187</td>
</tr>
<tr>
<td>Resources</td>
<td>67</td>
</tr>
<tr>
<td>Services</td>
<td>165</td>
</tr>
<tr>
<td>Technology</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>793</td>
</tr>
</tbody>
</table>

3.2 Measures

This segment specifically used a quantitative approach in this study. It explains the use of a self-administered questionnaires as being suitable for collecting data from the sample of manager in Listed Companies in the Stock Exchange of Thailand. According to existing literatures on customer focus, organizational learning capability, creative capability, this study develops a conceptual model based on theories to test the research hypotheses as discussed earlier. Hence, a quantitative method was carried out to test the hypotheses. Creswell and Creswell (2017) states that a quantitative approach is “a structured method for unifying deductive logic with defined empirical examinations of individual behavior in order to find and verify a set of probabilistic causal laws that can be used to predict general patterns of human activity”. One of the important parts in designing a questionnaire is the pretest of the questionnaire. By pretesting the questionnaire, the author can check for
appropriateness of measurement items, language, and structure of the questionnaire before giving it out to the respondents. From prior studies, multi-items scales were used for the measurement of the construct to examine the hypotheses mentioned above. Furthermore, this questionnaire used a five-point Likert scale to measure the items with the range of “strongly disagree” (1) to “strongly agree” (5). Based on the literature review, the factors in this study relate to their nature measurements. In the development process, the scales are composed of three major aspects which are item generation, pre-feasibility study, and feasibility study (Tu et al., 2004). Nevertheless, there is a complete in-depth literature review to identify a primary list of items and to define the constructs.

Moreover, a pre-feasibility study was completed to improve content validity with the help of analysis of scholars with expertise in innovation. This pre-feasibility analysis of the questionnaire was made to examine and evaluate the readability, adequacy, ambiguity, clarity, completeness, and appropriateness of each item to their respective constructs. Next, the feasibility study was organized on 30 firms managers. Lastly, the scales undergo corrected item-total correlation which means that the correlation of the scale to its item below 0.50 are evaluated on the scale reliability by Cronbach’s Alpha; however, the over 0.70 alpha values are considered as acceptable in this study.

3.3 Methodology

In this study, relationships mentioned in the Figure are analyzed and evaluated by a multivariate statistical method called structural equation modeling (SEM). Furthermore, SEM is more efficient in comparison to regression models for four reasons: firstly, it allows the data to be analyzed by using only manifest variables instead of latent variables as a different perspective from multiple regression. Secondly, SEM can use to resolve and lessen the issue of measurement. In addition, unlike standard regression procedures, SEM considered this measurement error within the data analysis (Muijs, 2004). Thirdly, issues found with multicollinearity cannot be solved by linear regression, but SEM can examine both correlated multiple dependent variables and correlated independent variables (Yang, 2004). Lastly, SEM can analyze many advanced techniques including immediate analysis of data from several different populations, multiple regression models, maximum likelihood estimation (MLE) of the missing data, and estimation of additive and means constants in regression equations (Yang, 2004). However, SEM has some disadvantages too, namely, the problem occurs when the model identification is either under-identified or overidentified model. Therefore, in the pre-feasibility study, the measurement model was examined to ensure the scales’ reliability and validity. Furthermore, the outcomes from the structural model were evaluate depending on the covariance matrix with the MLE method. The external variables were permitted to covariance in the model estimation and the results of the model were analyzed by many goodness-of-fit measures.

4. Analysis and results

4.1 Sample description

To investigate the sample in terms of non-response bias and also skewness and kurtosis is statistical necessity before the description of the sample. The first and fourth quartile respondents in this study were compared to test for non-response bias. This comparative analysis was performed by t-test on the mean responses of the two sets. Consequently, this result points to the absence of non-response bias. It was also inspected the univariate distributions of the observed variables to verify the hypothesis of multivariate normality distribution required to use MLE method. The univariate distributions of the variables were exjghamed for excessive skewness and/or kurtosis using Mardia’s coefficient test statistics which showed that the skewness and kurtosis of the variables were not statistically different from that of normal distributions. In statistics, a univariate distribution is a probability distribution of only one random variable. However, the multivariate
normal distribution model extends the univariate normal distribution model to fit vector observations (Das, 2008).

It shows, the respondents were employed by companies in many sectors, however, the software sector is the most frequently (32%) represented. A total of 793 valid questionnaires were gathered, as well as demographic and personal information about the respondents. There are 251 male respondents in the survey, accounting for 31.65% of the total population, while female and 68.35% are male. The span of age of respondents is 41-50 years old (32.67%). The majority of respondents are married (63.74%). Approximately 52.59% of the participants achieved a bachelor’s degree or equal and the most of the participants have more than 15 years of work experience (56.18%). Likewise, most of the participants have average salary per month of less than 75,000 baht (43.03%). Finally, the majority of the work positions of the key participants is that of general managers (31.87%).

4.2 Preliminary analysis

Furthermore, Cronbach’s Alpha statistics and variance explained of each construct were computed by confirmatory factor analysis (CFA). Cronbach’s Alpha of, 0.70, an elimination of the indicator with the lowest item-to-total correlation, is recommended (Nunnally and Bernstein, 1994). So, when the coefficient alpha was smaller than 0.70, the item with the lowest item-to-total correlation was removed until meeting the 0.70 level. According to Tarhini et al. (2016), “internal consistency signifies the extent to which respondents are reliable across the items mentioned in the questionnaire as a measurement scale”. Internal consistency is measured by Cronbach’s alpha, where 0.70 or above is considered acceptable (Pallant, 2013; Kline, 2015). The Cronbach’s alpha values for this study were: customer focus (0.901), organizational learning capability (0.912), creative capability (0.923), process innovation (0.893) product innovation (0.897) and firm performance (0.924). The association between all the structures in this analysis is used to determine discriminant validity. Table 2 indicates that the discriminant validity findings for the association between the pairs of constructs are less than 0.893, as researchers recommend (Voorhees et al., 2016; Henseler et al., 2015).

4.3 Measurement model

The measurement model with 26 items was also analyzed as a confirmatory factor analysis. The results of the measurement model can be shown in Table 2. Given the well-established validity of scale measures, each model construct was evaluated for convergent and discriminant validity. The convergent validity, which is the extent to which each measure correlates with other measures of the same construct, can be evaluated by item reliability. The strong (0.60) and significant (p < 0.05) individual item-construct loadings provide conclusive evidence in favor of inclusion of each indicator in the relevant construct. Moreover, composite reliability (CR) and average variance extracted (AVE) values for the constructs in the model were computed.

The facts that CR scores are all greater than 0.70 and AVE scores are all greater than 0.50 indicated that the constructs met statistical requirements accurately (Hair et al., 1995). These results provide conclusive evidence in favor of inclusion of each indicator in the relevant construct. The discriminant validity was examined by comparing the squared correlation between two latent constructs to their AVE estimates. According to this test, the squared correlation between each pair of constructs should be less than the AVE for each individual construct (Fornell and Larcker, 1981).

As shown in Table 2, none of the off-diagonal elements, squared correlations, is higher than the diagonal elements, AVE, for each individual construct. These results provide strong evidence of discriminant validity among the theoretical constructs. Also, the above results indicated a sufficient degree of reliability and validity. So, it can be concentrated on the measurement model now.

The fit statistics and indices of the measurement model were also within the acceptable range. The $\chi^2$ of the final measurement model was significant ($\chi^2 = 1562.07$, df = 807, p < 0.001).
According to $\chi^2$ statistic, the model fit may not be considered satisfactory. The reason for this can be the small sample size, because $\chi^2$ is a direct function of sample size (Hartwick and Barki, 1994) and the sensitivity of the $\chi^2$ statistics to sample size (Das and Nenadic, 2009).

However, the normed $\chi^2$ (1.93) was within the acceptable range (2.0) and other measures of the model fit were satisfied as well. In addition, the goodness of the fit indices (GFI = 0.923, AGFI = 0.909, CFI = 1.000, $\chi^2$/ df = 0.887 and RMSEA = 0.050) were adequate according to threshold values made by Hu and Bentler (1995). Additionally, values of the root mean square error of approximation (RMSEA = 0.05) and root mean square residual (RMSR = 0.05) were in the generally accepted guideline (Browne and Cudeck, 1992) of 0.05 for good fit. The overall goodness-of-fit indices indicated that the model was acceptable.

**Table 2:** The measurement model

<table>
<thead>
<tr>
<th>Path to</th>
<th>Path from</th>
<th>Factor loading</th>
<th>t-value</th>
<th>CR</th>
<th>AVE</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFF1</td>
<td>Customer focus</td>
<td>.704</td>
<td></td>
<td>0.92</td>
<td>0.77</td>
<td>0.69</td>
</tr>
<tr>
<td>CFF2</td>
<td>.847</td>
<td></td>
<td>11.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFF3</td>
<td>.857</td>
<td></td>
<td>11.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFF4</td>
<td>.837</td>
<td></td>
<td>11.76</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFF5</td>
<td>.850</td>
<td></td>
<td>10.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFF6</td>
<td>.829</td>
<td></td>
<td>9.39</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OLCC1</td>
<td>Organizational learning capability</td>
<td>.816</td>
<td></td>
<td>0.94</td>
<td>0.85</td>
<td>0.72</td>
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<tr>
<td>OLCC2</td>
<td>.850</td>
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<td>20.22</td>
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<tr>
<td>OLCC3</td>
<td>.861</td>
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<td>CCC1</td>
<td>Creative capability</td>
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<td>0.93</td>
<td>0.80</td>
<td>0.63</td>
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<td>14.80</td>
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<td>PRO_INN1</td>
<td>Product innovation</td>
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<td>0.88</td>
<td>0.76</td>
<td>0.59</td>
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<tr>
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<tr>
<td>PRO_INN3</td>
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<td>11.79</td>
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<tr>
<td>PRE_INN1</td>
<td>Process innovation</td>
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<td></td>
<td>0.92</td>
<td>0.83</td>
<td>0.69</td>
</tr>
<tr>
<td>PRE_INN2</td>
<td>.887</td>
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<td>Firm performance</td>
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<td>0.98</td>
<td>0.95</td>
<td>0.91</td>
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<td>FPP2</td>
<td>.943</td>
<td></td>
<td>39.96</td>
<td></td>
<td></td>
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<tr>
<td>FPP3</td>
<td>.921</td>
<td></td>
<td>30.48</td>
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**Table 3:** Discriminant validity of the measurement model

<table>
<thead>
<tr>
<th>Latent construct</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Customer focus</td>
<td>0.81</td>
<td>0.63</td>
<td>0.31</td>
<td>0.45</td>
<td>0.25</td>
<td>0.15</td>
</tr>
<tr>
<td>2 Organizational learning capability</td>
<td>0.70</td>
<td>0.37</td>
<td>0.43</td>
<td>0.39</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>3 Creative capability</td>
<td>0.72</td>
<td>0.19</td>
<td>0.23</td>
<td>0.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Product innovation</td>
<td>0.76</td>
<td>0.14</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4 Structural equation model analysis

Once all structures have been checked and an optimal match has been achieved (Kline, 2015; Sass et al., 2014), a structural model can be evaluated and obtained as a second and crucial stage of the study (Field, 2013). The structural model is specified as “the portion of the model that specifies how the latent variables are related to each other” (Field, 2013). The aim of a structural model is to figure out which latent variables influence the values of other constructs directly or indirectly (Kline, 2015) (see Figure 1). The findings demonstrate that the structure model is well fitted, resulting in Chi-square = 7.922, df = 9, $\chi^2$/ df = 0.880, GFI = 0.993, AGFI = 0.919, CFI = 1.000, RMSEA = 0.000.

Standardized regression beta weights are represented by the values for the paths linking constructs with a single headed arrow. The values at the boxes’ edges are variance estimations, in which the sum of variance in the measured variables interpreted by latent variables or causes, and the values next to the double headed arrows are correlations, much as in the measuring model.

Table 4 shows the results of this study’s structural model assessment. The hypotheses H1, H2, H3, H4, H5, H6, H7 and H8 are statistically significant and in the hypothesized direction when tested against the model.

Table 4: Summarized CFA Results

<table>
<thead>
<tr>
<th>Construct</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2$/df</th>
<th>GFI</th>
<th>AGFI</th>
<th>CFI</th>
<th>RMSEA</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer focus</td>
<td>0.461</td>
<td>5</td>
<td>0.0922</td>
<td>0.906</td>
<td>0.971</td>
<td>0.982</td>
<td>0.020</td>
<td>0.652</td>
</tr>
<tr>
<td>Organizational learning</td>
<td>0.237</td>
<td>3</td>
<td>0.079</td>
<td>1.000</td>
<td>0.998</td>
<td>1.000</td>
<td>0.000</td>
<td>0.641</td>
</tr>
<tr>
<td>Creative capability</td>
<td>2.953</td>
<td>2</td>
<td>1.4765</td>
<td>0.995</td>
<td>0.930</td>
<td>0.997</td>
<td>0.031</td>
<td>0.653</td>
</tr>
<tr>
<td>Product innovation</td>
<td>0.461</td>
<td>1</td>
<td>0.461</td>
<td>0.963</td>
<td>0.952</td>
<td>1.000</td>
<td>0.000</td>
<td>0.611</td>
</tr>
<tr>
<td>Process innovation</td>
<td>0.205</td>
<td>1</td>
<td>0.205</td>
<td>1.000</td>
<td>0.996</td>
<td>0.953</td>
<td>0.000</td>
<td>0.599</td>
</tr>
<tr>
<td>Firm performance</td>
<td>0.246</td>
<td>1</td>
<td>0.246</td>
<td>1.000</td>
<td>0.997</td>
<td>0.972</td>
<td>0.000</td>
<td>0.621</td>
</tr>
</tbody>
</table>

Now that the measurement model is reliable and valid, the structural model can be examined. It was used to test the causal model shown in Figure 1. The model was analyzed using AMOS 4.0 to interpret the model or assess the significance of model paths to first ensure that the model itself has an adequate fit. Several statistics are cited in Table 4 indicating an acceptable fit of the model to the data. Based on these results, summarized in Table 4, it is appropriate to interpret the path estimates from the model.

Hypotheses between H1 and H7 concern the relationships between product innovation and its antecedents. H1, H2, H3, H4, H5, H6, and H7 were supported. Contrary to our expectations, we failed to demonstrate that customer focus, organizational learning capability, and creative capability have a significant positive direct effect on product innovation. While the most potent effect on product innovation is the creative capability (0.42), the least was firm performance (0.55). Hypotheses between H1 and H7 concern the relationships between process innovation and its antecedents. However, customer focus, organizational learning capability, and creative capability do have a direct positive effect on process innovation.

H7 and H8 concern the relationships between innovation type (product/process) and firm performance. These hypotheses were supported by survey data. The strongest effect from these two types on firm performance was product innovation (0.42, 0.55 respectively). The implications of these results are discussed in the next sections.
Chi-square = 7.922, df = 9, χ²/ df = 0.880, GFI = 0.993, AGFI = 0.919, CFI = 1.000, RMSEA = 0.000

**Figure 1** Structural Equation Model

**Table 5:** Testing Hypotheses using Standardized Estimations

<table>
<thead>
<tr>
<th>Structural Relationship</th>
<th>Standardized Parameter Estimate</th>
<th>S.E.</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: CFF--&gt;PRO_INN</td>
<td>1.149</td>
<td>0.185</td>
<td>4.650</td>
<td>0.001***</td>
</tr>
<tr>
<td>H2: CFF--&gt;PRE_INN</td>
<td>0.990</td>
<td>0.080</td>
<td>13.922</td>
<td>0.000***</td>
</tr>
<tr>
<td>H3: OLCC--&gt;PRO_INN</td>
<td>0.149</td>
<td>0.262</td>
<td>3.752</td>
<td>0.000***</td>
</tr>
<tr>
<td>H4: CFF--&gt;PRE_INN</td>
<td>0.430</td>
<td>0.128</td>
<td>2.882</td>
<td>0.000***</td>
</tr>
<tr>
<td>H5: CCC--&gt;PRO_INN</td>
<td>0.318</td>
<td>0.235</td>
<td>3.721</td>
<td>0.000***</td>
</tr>
<tr>
<td>H6: CCC--&gt;PRE_INN</td>
<td>0.530</td>
<td>0.280</td>
<td>3.852</td>
<td>0.000***</td>
</tr>
<tr>
<td>H7: PRO_INN--&gt;FPP</td>
<td>0.898</td>
<td>0.234</td>
<td>3.212</td>
<td>0.000***</td>
</tr>
<tr>
<td>H8: PRE_INN--&gt;FPP</td>
<td>0.783</td>
<td>0.128</td>
<td>2.324</td>
<td>0.000***</td>
</tr>
</tbody>
</table>

5. Conclusion and Limitations

This study used the multivariate model to examine the antecedent factors of product innovation (CFF, OLCC, and CCC), product and process innovation type, and firm performance of Listed Companies in the Stock Exchange of Thailand. Notably, the model in this study is fit to display a simple linear relationship among these constructs, innovation factors, and innovation; however, the relationships among them are interrelated and complex in sophisticated ways. Despite the lack of empirical evidence for direct or linear relationships, it can still be inferred that the constructs could be indirectly related to each other. According to the analysis of the findings, it can be concluded that when customer focus and creative capability are positively influenced by product innovation level, then organizational learning capability will be positively affected by process innovation. Therefore, both product and process types of innovation have a positive and direct effect on firm performance. Furthermore, many factors are either statistically related to process innovation or product innovation. Wang and Ahmed’s (2004) stated that product innovation accentuated on the result-oriented of innovative capability, but overlooked the significance of other factors which are strategic orientation, process innovation, and behavioral changes towards innovation. Hence, there is one factor that is statistically related to product innovation, but not to process innovation, so it cannot be concluded as the only product innovation predictor because the right processes can create the right products. Meanwhile, there is also some directly negative factor for product innovation or process innovation that is indirectly related to innovation practices.

The results of this study on managers of Listed Companies in the Stock Exchange of Thailand are separated into two groups: first, managers who focus on product innovation, and second, those who focus on process innovation. In the first group, the managers should focus on the growth of internal and external connections. Namely, internal connection helps in developing and proposing new

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solutions or ideas. In addition, an R&D strategy can help improve the firm resources and evaluate the employees to strengthen the internal connection. Meanwhile, external connection focuses on the firm’s customers and suppliers by using the evaluation of customer needs (Santos-Vijande and Alvarez-Gonzales, 2007). Besides, with the continuous innovative effort of customer focus applications, the two components of proactive strategies which are close relations and comprehensive market research with existing customers can influence the novelty in the market. Additionally, the firm sales representatives can be employed to strengthen the relationship with the suppliers can improve the firm innovation practice by integrating the supplier’s skill of designing and manufacturing new products (Nahm et al., 2004). In the second group, managers should encourage training and learning courses within or outside the firm, so the employees can integrate work and learn under a single system to retain the learning environment within the organization (Garcia-Morales et al., 2007).

Essentially, managers should be careful of many aspects mentioned in the following: firstly, all firm departments must be strictly informed that innovation is a never-ending process that works well within a corporate culture. Secondly, the main source of innovative developments is the employees and the managers should influence their employees by rewards, incentives, materials, and necessary funds to work in collaboration because innovation is a collective achievement. Thirdly, managers should have skills in planning (functions, members, and needs) and designing (policies, strategies, and systems) appropriately in each time and place (Garcia-Morales et al., 2007). Thus, for rewards, managers need to reflect on how they could utilize their resources more efficiently (Prajogo et al., 2007). In addition, they must create their communications strategy depending on the nature of the information and the cultural context (Persaud, 2005). On the other hand, the level of entrepreneurial culture can be assessed by the context of TMS, strategy, and creativity. Lastly, managers must also identify the need for decision and relational support (Lee and Kelley, 2008). The outcomes of this study will also help the companies under Listed Companies in the Stock Exchange of Thailand by providing them with essential information on how their actions and policies might influence the firm innovation. This study can be beneficial for future studies on planning a system for assessing the STPs' performance, and it can be used as a tool for another research that shares a similar topic.

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References


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