RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Guidelines for Integrating Innovation into Electric Power Management for the Utmost Efficiency in Manufacturing Industry

By

Ronnakorn Klavikrum
Ph.D.Student King Mongkut's University of Technology North Bangkok , Thailand 10800

Thitirat Thawornsujaritkul
Assistant Professor Dr King Mongkut's University of Technology North Bangkok , Thailand 10800

Thanin Silpcharu
Professor Dr King Mongkut's University of Technology North Bangkok , Thailand 10800

Abstract

Electric power security is important for economic expansion in the manufacturing industry. This study was aimed to investigate the guidelines for integrating innovation into electric power management for the utmost efficiency in the manufacturing industry. Both qualitative and quantitative studies were conducted. The data were collected from 500 respondents responsible for energy in the manufacturing industry in factories. Descriptive, referential, and multivariate statistics were used to analyze the data.

It was found that the guidelines for integrating innovation into electric power management for the utmost efficiency in the manufacturing industry were of 4 components arranged in the order of importance recognition as follows: Process Innovation ($\overline{X}$ = 4.47), Teamwork ($\overline{X}$ = 4.45), Culture ($\overline{X}$ = 4.44), and Monitoring and Control ($\overline{X}$ = 4.43) respectively. The most important guideline item found in each aspect were: the management supporting the implementation of systematic energy management, all employees driving energy management measures together, creating corporate values in energy management, and monitoring the implementation of measures efficiently, respectively. The hypothesis testing showed, as a whole, that the respondents in both small and large factories similarly recognized the importance of guidelines for integrating innovation into electric power management for the utmost efficiency in the manufacturing industry at the statistical significance level of 0.05.

The analysis of the developed structural equation model revealed that it passed the assessment criteria and was consistent with the empirical data. The calculated values of probability of chi-square were 0.120, the relative chi-square was 1.131, the index of consistency was 0.965, and the root means squared error of approximation was 0.016 respectively.

Keywords: Integration, Innovation, Electrical power management, Manufacturing industry

Introduction

Energy Security is important for the country's economic expansion. especially in the manufacturing industry that can create Gross Domestic Product (GDP) is the largest in the country. But on the other hand, it consumes a lot of electricity. in the country as well, as shown in Figure 1.

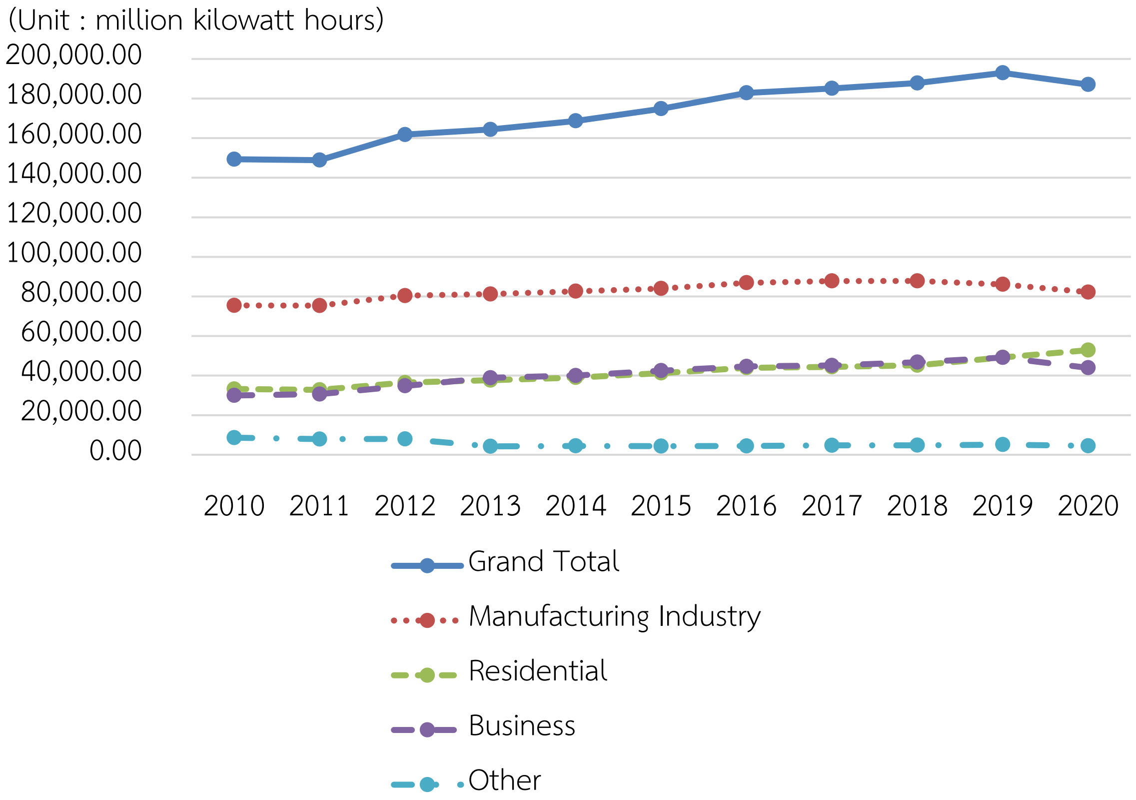

Figure 1 Graph of total electricity consumption classified by economic sector 2010-2020
Source: Department of Alternative Energy Development and Efficiency (2020)

From Figure 1, the manufacturing sector (Manufacturing Industry) From 2010 to 2020, it was found that the use of electricity was the highest for 11 years and currently there is a trend of continuous increase in electricity consumption. During that same period The electric power generation of the Electricity Generating Authority of Thailand decreased. But the purchase from abroad has increased, it can be seen that the electricity supply is insufficient to meet the domestic demand (Department of Alternative Energy Development and Efficiency, 2020), in line with the Power Development Plan of Thailand (PDP2018) stated. that Thailand has an energy security problem (Department of Energy Policy and Planning Office, 2018)

Research objectives

To study the guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry.

To develop a structural equation model(SEM), an approach for guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry.

Research hypothesis

Derived from the research objectives and literature related to the topic, the researcher, therefore, formulated the hypothesis of the research according to the theory. which can be summarized into 7 hypotheses of the research as follows:

1 Teamwork components Direct influence on Process Innovation components. (Elrehail et al., 2018) (Semuel, Siagian and Coctavia, 2017)
2 Teamwork components Direct influence on Monitoring and Control components. (Ibrahim, 2015) (Yildiz, Basturk and Boz, 2014)
3 Teamwork components direct influence on Culture components. (Bouwmans et al., 2017) (Elrehail, 2018)
4 Culture components Direct influence on Monitoring and Control components. (Muthuveloo, Shanmugam and Teoh, 2017) (Acar et al., 2017)
5 Culture components Direct influence on Process Innovation components. (Alshanty and Emeagwali, 2019) (Martínez-Pérez, Elche and García-Villaverde, 2019)
6 Monitoring and Control components Direct influence on Process Innovation components. (Hong et al., 2019) (Zhang, Rong and Ji, 2019)
7 Importance of an innovative integrated approach to the most efficient management of electric power in the manufacturing industry as a whole. When classified according to the size of the controlled factory, there are evident differences. (Petruzzelli, Ardito and Savino, 2018)

Research method

This research was conducted to create a new body of knowledge using mixed research

1 Qualitative Research' with in-depth interview techniques inclusive of nine experts that comprised of 3 industrial business administration experts, 3 government or related executives experts, and 3 academic experts. The nine experts were interviewed with open-ended questions based on the 4 components reviewed from relevant theories and literature, of which 4 components. They are 1). Teamwork , 2). Culture, 3). Process Innovation, and 4). Monitoring and Control. The Index of Item Objective Congruence (IOC) was between 0.80–1.00 (accepted at > 0.5) when 100 questions in all 4 components were tested and analyzed. The confidence value of the questionnaire by finding Cronbach's Alpha Coefficient was 0.990 (accepted > 0.8). with standard deviation analysis, The values were between 0.45–1.74 and the question scale was estimated. By analyzing the Corrected Item–Total Correlation values, the values were between 0.45–0.89, respectively.
2 Quantitative Research' was conducted by sending a questionnaire to people in charge of energy in the manufacturing industry in large and small designated factories in the manufacturing industry. The three-month process involved collecting data from a total population of 5,899, of which the sample size of 500 (Comrey and Lee, 1992, referenced in Thanin, 2020) comprised 250 from large disignated factories and 250 from small disignated factories. The questionnaire was formed to have a checklist and a rating scale. The criterion for the weight value was defined as 5 levels according to the Likert method. Data analysis was done using both descriptive statistics. Statistics were referenced by the SPSS software package. A (SEM) Structural Equation Model

was developed using AMOS software and thus there were 4 criteria for Evaluating the Data-Model Fit: 1). Chi-square probability greater than 0.05, 2). Relative chi-squared less than 2.00, 3). Conformity index greater than 0.90 and 4). Root mean squared index of estimation error less than 0.08.

3 Further, A 'Qualitative research' that used Focus Group Techniques, in which 11 experts certified the SEM for the innovative integration into electric power management with the highest efficiency in the manufacturing industry.

Research Results

Table 1 The research results on the importance of integrating innovation into the most efficient management of electric power in the manufacturing industry were classified by the size of the disignated factory.

Guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry	Small Disignated Factory			Large Disignated Factory		
	$\bar{X}$	S.D.	priority	$\bar{X}$	S.D.	priority
Overview	4.44	0.44	high	4.45	0.40	high
1. Teamwork	4.47	0.42	high	4.44	0.43	high
2. Culture	4.43	0.47	high	4.44	0.460	high
3. Process Innovation	4.45	0.48	high	4.48	0.41	high
4. Monitoring and Control	4.42	0.50	high	4.44	0.464	high

Table 1 shows the overall importance level and the four components of the structural equation model, the approach of integrating innovation towards the most efficient management of electric power in the manufacturing industry. The small disignated factory found that overall, it was at a high level. The mean was 4.44 and when considering each aspect, it was found that all aspects were of high importance. in terms of Teamwork The highest mean ($\bar{X}$=4.47), followed by Process Innovation ($\bar{X}$=4.45), Culture ($\bar{X}$=4.43), and Monitoring and Control ($\bar{X}$=4.42), respectively.

The large disignated factory found that overall, it was at an extremely higher level. It had an average of 4.45 and when considering each aspect, it was found that all aspects are of great importance. in terms of Process Innovation The highest mean ($\bar{X}$ = 4.48), followed by Teamwork ($\bar{X}$=4.44), Culture ($\bar{X}$=4.44), and Process Innovation ($\bar{X}$=4.44), respectively.

The results of the comparison of the importance level of the guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry. Overall, when classified by the size of the disignated factory, it was found that there was no statistically significant difference at the 0.05 level.

Criteria to assess the conformity of the SEM, the approach of guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry. Shown below in Table 2.

Table 2 Criteria for conformity assessment of the Structural Equation Model (SEM) comparasion before improvement and after improvement.

Evaluating the Data–Model Fit	Criteria	Before Improvement	After Improvement
CMIN-p (Chi-square Probability Level)	Value > 0.05	0.000	0.120
CMIN/DF (Relative Chi-square)	Value < 2.00	1.958	1.131
GFI (Goodness of Fit Index)	Value > 0.90	0.708	0.965
RMSEA (Root Mean Square Error of Approximation)	Value < 0.08	0.044	0.016

From Table 2 , the results of the model before improvement. it was found that passes only 2 criterias are namely Chi-square Probability Level is 1.958, which is less than 2.00, and The Root Mean Square Error of Approximation was 0.044, which is less than 0.08. Therefore, the researcher had improved that the model with accordance to Arbuckle's (2011) recommendation, that considers the value of the resulting program to eliminate some improper observational variables one by one. Upon updating the model, it was found that the Chi-square Probability Level is 0.120 which is greater than 0.05, the Relative Chi-square is 1.131, which is less than 2.00, the Goodness of Fit Index is 0.965, which is greater than 0.90, and the Root Mean Square Error of Approximation was 0.016, which is less than 0.08. It was concluded that the model passed the assessment criteria and was aligned with the empirical data.

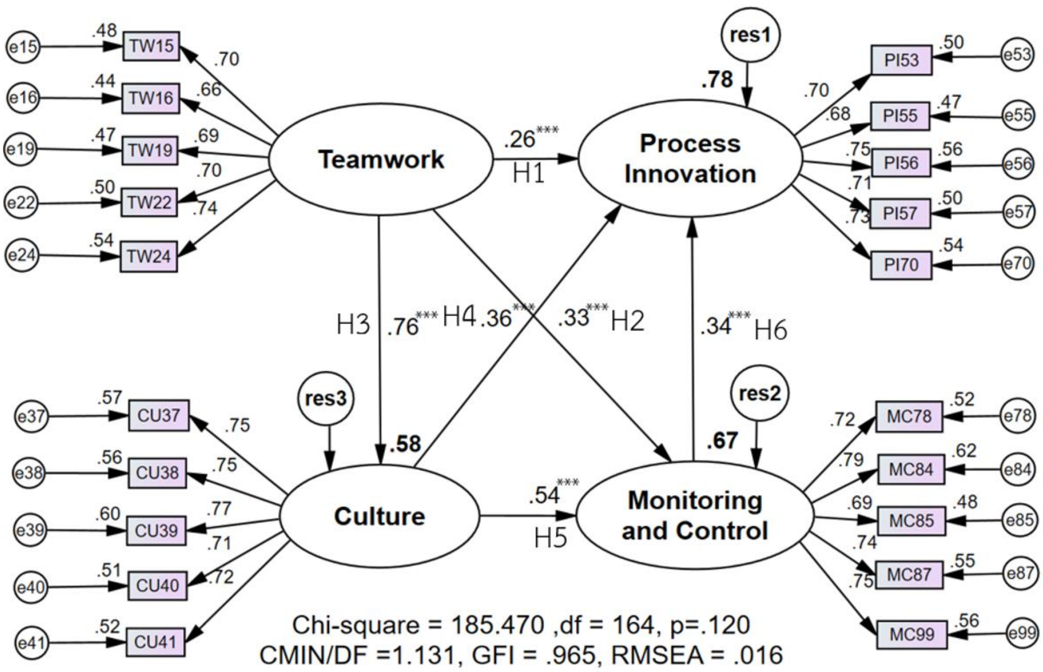

Figure 2 Guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry in Standardized Estimate model.

From Figure 2, the results of the analysis of the causal influence between the variables in the approach of integrating innovation towards the most efficient management of electric power in the manufacturing industry using the Standardized Estimate Mode, it was found that research hypothesis No. 1: Teamwork components: Direct influence on Process Innovation components with a statistical significance at the 0.001 level, was weighted equal to 0.26. Research hypothesis No. 2: Teamwork components: Direct influence on Monitoring and Control components with a statistical significance at the 0.001 level, was weighted equal to 0.33. Research Hypothesis No. 3: Teamwork Components: direct influence on Culture elements with a statistical significance at the 0.001 level was weighted equal to 0.76. Research hypothesis No. 4: Culture components: Direct influence on Process Innovation components with a statistical significance at the 0.001 level was weighted equal to 0.36 and the research hypothesis No. 5: Culture components: Direct influence on Monitoring and Control components with a statistical significance at the 0.001 level was weighted equal to 0.54. Research hypothesis No. 6: Monitoring and Control components: Direct influence on Process Innovation components with a statistical significance at 0.01 level was weighted equally to 0.34. The statistical value obtained from the model analysis after model improvement is shown in Table 3.

Table 3 Statistical values obtained from structural equation model analysis after model improvement

Variables	Estimate		R^2	Variance	C.R.	P
	Standard	Unstandard				
Teamwork				0.20		
TW15	0.70	1.00	0.48	0.21		
TW16	0.66	0.88	0.44	0.20	13.21	***
TW19	0.69	0.93	0.47	0.20	13.65	***
TW22	0.70	1.00	0.50	0.20	13.98	***
TW24	0.74	1.03	0.54	0.18	14.53	***
Culture			0.58	0.10		
CU37	0.75	1.00	0.57	0.21		
CU38	0.75	1.02	0.56	0.18	16.61	***
CU39	0.77	1.08	0.60	0.19	17.11	***
CU40	0.71	0.95	0.51	0.21	15.74	***
CU41	0.72	0.97	0.52	0.19	15.92	***
Process Innovation			0.78	0.05		
PI53	0.70	0.89	0.50	0.18		
PI55	0.68	0.92	0.47	0.21	14.62	***
PI56	0.75	1.05	0.56	0.19	16.07	***
PI57	0.71	0.99	0.50	0.21	15.19	***
PI70	0.73	1.00	0.54	0.19	15.05	***

Table 3 (continued)

Variables	Estimate		R^2	Variance	C.R.	P
	Standard	Unstandard				
Monitoring and Control			**0.67**	**0.07**		
MC78	0.72	1.00	0.52	0.19		
MC84	0.79	1.16	0.62	0.17	16.55	***
MC85	0.69	0.98	0.48	0.21	14.56	***
MC87	0.74	1.14	0.55	0.22	15.58	***
MC99	0.75	1.12	0.56	0.19	15.81	***

*** It was statistically significant at the 0.001 level.

From Table 3, The teamwork component consists of 5 'Observed Variables', arranged in order of weight values. (Standardized Regression Weight) The 1st Variable: Leaders' ability to manage conflicts effectively to support eliminate conflict (TW2 4) (Standardized Regression Weight) of 0.74 was statistically significant at the .001 level, the multiple squared correlations (R2) 0.54 the variance 0.18. The 2nd Variable: All employees share a mission to manage energy (TW2 2) (Standardized Regression Weight) 0 .7 0 was statistically significant at the. 001, the squared multiple correlations (R2) 0.50, the variance 0 .2 . The 3rd Variable: There is a good relationship between management and employees, (Relationship) (TW1 5) (Standardized Regression Weight) 0 . 7 0 , the squared multiple correlation (R2) 0.48, the variance 0.21. The 4th Variable: Working Atmosphere (TW19) (Standardized Regression Weight) 0 .6 8 was statistically significant at the .0 0 1 level, the squared multiple correlations (R2) 0 .4 7 , the variance 0 .2 0 . The 5th Variable: Raising awareness towards willingness (TW16) (Standardized Regression Weight) 0 . 6 6 was statistically significant at the .0 0 1 level, the squared multiple correlations (R2) 0 .4 4 , the variance 0.20.

Culture components consisted of 5 observed variables, arranged in order of weight values. (Standardized Regression Weight) from highest to lowest as follows: The 1st Variable: Activity Energy Conservation Promotion (CU39) (Standardized Regression Weight) 0.77 was statistically significant at the .001 level, the squared multiple correlations (R2) 0.60, the variance 0.19. The 2nd Variable: Training for employees to understand the organizational culture (Educate) (CU37) (Standardized Regression Weight) 0.75 was statistically significant at the .001 level, the squared multiple correlation (R2) 0.57, the variance 0.18. The 3rd variable: Employee acceptance of the energy management culture. (Acknowledge) (CU38) (Standardized Regression Weight) 0.75 was statistically significant at the .001 level, the squared multiple correlation (R2) 0.57, the variance 0.21. The 4th variable: Making all employees see the value of energy until the culture, 'Power Management' (Appreciate) (CU40) (Standardized Regression Weight) 0.71 was statistically significant at the .001 level, the squared multiple correlation (R2) 0.51, the variance 0.21. The 5th variable, All employees had a culture of emotional expression of good energy management. (Expression) (CU41) (Standardized Regression Weight) 0.72, the squared multiple correlation (R2) 0.52, the variance 0.19.

The 'Process Innovation' component consists of 5 Observed Variables arranged in order of weight. (Standardized Regression Weight) from highest to lowest as follows: The 1st Variable: Search for new innovations in energy management processes (PI56) (Standardized Regression Weight) 0.75, squared multiple correlation (R2) 0.56 and the variance 0.17. The 2nd Variable: There was a procedure to save energy (Procedure) (PI70) Weight (Standardized Regression Weight) 0.73 was statistically significant at the .001 level, the squared multiple correlation (R2) 0.54, the variance 0.22. The 3rd Variable: Combined electric power e.g. the use of main electricity combined with solar energy, etc. (Renewable energy) (PI57) (Standardized Regression Weight) 0.71 had a statistical significance at the .001 level, the squared multiple correlation (R2) 0.50, the variance of 0.19. The 4th Variable: Promote the application of innovation in energy management (PI53). The (Standardized Regression Weight) of 0.70 was statistically significant at the .001, squared multiple correlation (R2) 0.50, the variance 0.19. The 5th Variable: Specific Optimization The picture of energy consumption to the device consuming high amounts of electricity(Specificity) (PI55) (Standardized Regression Weight) 0.68 was statistically significant at the .001 level, multiple squared correlations (R2) 0.47, the variance 0.21.

The Monitoring and Control component consisted of 5 Observed Variables arranged in order of weight value. (Standardized Regression Weight) from highest to lowest, as follows: The 1st variable: Analysis of error points of the measure for improvement (MC84) (Standardized Regression Weight) 0.79 was statistically significant at the .001 level, squared correlation (R2) 0.62, the variance 0.19. The 2nd Variable: Audit report (MC99) (Standardized Regression) Weight 0.75 statistically significant at the .001 level, Squared Multiple Correlations (R2) 0.56, the variance 0.21. The 3rd Variable: A sub-committee to document the auditing report (MC87) (Standardized Regression Weight) 0.74 was statistically significant at the .001 level, squared multiple correlation (R2) 0.55, the variance 0.21. The 4th Variable: Reporting of assessment results and proposing a measure to correct problems and obstacles (MC78) (Standardized Regression Weight) 0.72 statistically significant at the .001 level, the squared multiple correlations (R2) 0.52, the variance 0.19 and the 5th Variable: the budget control is in accordance with the objectives. ‘Control Budget’ (MC85) (Standardized Regression Weight) 0.69 was statistically significant at the .001 level, squared multiple correlations (R2) 0.48, the variance 0.19.

Discuss the results of the research.

Key points deduced from the research findings based on the approach of guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry. The key points are also identified as a guideline for managing electric power in the manufacturing industry to bring maximum efficiency in energy management under today's rapidly changing technological environment in order to create long-term success.

From the results of this research, the researcher based on discussions, and the relevant research documents to support or contradict the 5 items mentioned below and thus reached a conclusion:

Based on research results when comparing the components of an guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry. There was no significant difference in the size of the group 1 small designated factory (1 person responsible for energy) and group 2 large designated factory (2 or more person responsible for energy). The statistical significance of .05 was due to the group 1 small designated factory (1 person responsible for energy) and group 2 large designated factory (2 or more person responsible for energy) had a similar management process, the consumed energy were similar in numbers, because both industries follow the energy management procedures of the Ministry of Energy. (Department of Alternative Energy Development and Efficiency, 2009). In addition, energy management procedures according to ISO50001 standards and the Energy Conservation Promotion Act B.E. 2535 (amended 2007) do not classify procedures according to the size of the factory or control factors such a small designated factories vs. large designated factories. However, it must be identified that there is a different approach to energy management (Wongsapai, 2016).

Innovative integration approach to electric power management with the highest efficiency in the manufacturing industry in ‘Process Innovation’, with an average of 4.47, which is the highest average. ‘Process Innovation’ is very important in energy management. These include controlling, data collection and monitoring, performance evaluation and management, internal and external comparisons and benchmarking (internal & external) and internal reporting, form the framework of integrative energy management (Schulze et al., 2016) Thus process innovation, is important in energy management and therefore requires an effective evaluation (May et al., 2017). The advanced technology as part of process innovation is very important for increase the efficiency of manufacturing processes (Wantanakomol, 2021).

Approaches for integrating innovations into electric power management with the highest efficiency in the manufacturing industry in the field of Process Innovation, found that executives support organizing energy management with average values that equal to 4.59 stating the utmost importance that top management has an influence on energy management (Wongsapai, 2016), and top management has a direct effect on the efficiency of corporate management (Shao, Feng and Hu, 2017).

From the hypothesis testing, it was found that the teamwork component directly influenced the cultural component and had the highest Influence Line (Standardized Regression Weight) at 0.76. Working together (Teamwork) plays an important role in creating a culture (Culture) for energy management within the organization. And it is an important part that allows executives to communicate with employees to give everyone in the organization a clear picture on how to manage energy together. Teamwork is therefore an important part of building a culture (Bouwmans et al., 2017). Teamwork leads to a better organizational culture (Naqshbandi and Jasimuddin, 2018). Teamwork is also connected to Energy Policy for creating Culture. (Thawornsujaritkul and Boonnual, 2017)

According to the hypothesis testing, Teamwork has the highest overall influence on the ‘Process Innovation’ component, with the highest Influence Line (Standardized Regression Weight) at 0.78, as proven by the data found. Evidently, teamwork plays an important role in creating process innovation in energy management within the organization. Therefore, it plays an integral part and allows the executives to communicate with the employees and give everyone in the organization a clear picture of how to manage energy together. Working together (Teamwork) can drive process innovation effectively (Damrongsak and Wongsapai, 2017), and teamwork affects process innovation (Wongsapai, 2016). Teamwork is also connected to digital technology, which is an co-efficient for improving process innovation (Silpcharu and Noongam, 2020).

Summary of research results

An guidelines for integrating innovation into electric power management for the utmost efficiency in manufacturing industry consists of 4 main components. The priorities are as follows:

Teamwork components include all employees driving common energy management measures. The management has good leadership in implementing energy management measures together and the management ensures being a good role model to encourage team work within the organization.

Culture components include executives and committees having clear policies to create a culture in energy management. Creating corporate values in energy management and building the understanding to support energy management.

Process Innovation components is the review of the effective implementation of measures, efficient control of energy management measures, reporting on assessment results and proposing measures to solve problems and obstacles.

The Monitoring and Control components include management to support the implementation of systematic energy management. Employees strictly comply with energy management regulations thereby setting goals to measure effective measures.

Suggestions for next research

1 In conclusion, the researcher recommends that a similar study is conducted aligning other researchers or research studies from other fields of economy, namely: Residential and Business because the two economic sectors are correlated. As further studies are needed for these sectors, that consume more than half of the total electricity supply in the country.

2 Recommend other interested researchers to further investigate more on the integration of cooperation. (Collaboration) between three sectors, namely the public sector, the private sector ,and the academic department for government policies to be supported; and further implemented by the private sector whilst receiving sound advice from the affiliated academic departments.

3 Further recommending other researchers to partake in researches based on personality, characteristics, and practices including the form of delegation of authority towards those who may be responsible in the field of energy for their the organization. Addressing and investigating high-level executives (Top management) who are successful in energy management and encouraging them to create a good model for the higher management to manage energy consumption.

References

Acar, M. F., Tarim, M., Zaim, H., Zaim, S., & Delen, D. (2017). Knowledge management and ERP: Complementary or contradictory? *International Journal of Information Management, 37*(6), 703-712. https://doi.org/10.1016/j.ijinfomgt.2017.05.007

Alshanty, A. M., & Emeagwali, O. L. (2019). Market-sensing capability, knowledge creation and innovation: The moderating role of entrepreneurial-orientation. *Journal of Innovation & Knowledge, 4*(3), 171-178. https://doi.org/10.1016/j.jik.2019.02.002

Arbuckle, J. L. (2011). IBM SPSS Amos 20 user's guide. *Amos Development Corporation, SPSS Inc,* 226-229. http://www.csun.edu/itr/downloads/docs/IBM_SPSS_Amos_User_GuideV23.pdf

Bouwmans, M., Runhaar, P., Wesselink, R., & Mulder, M. (2017). Fostering teachers' team learning: An interplay between transformational leadership and participative decision-making? *Teaching and Teacher Education, 65*, 71-80. https://doi.org/10.1016/j.tate.2017.03.010

Comrey, A., & Lee, H. (1992). Interpretation and application of factor analytic results. *Comrey AL, Lee HB. A first course in factor analysis, 2*, 1992.

Damrongsak, D., & Wongsapai, W. (2017). Personnel Responsible for Energy Capacity Building Programs for Sustainable Energy Efficiency in Thailand. *Energy Procedia, 110*, 59-64. https://doi.org/10.1016/j.egypro.2017.03.106

Efficiency, D. o. A. E. D. a. (2009). "Energy Management Procedures." Energy Conservation Potential Assessment.

Efficiency, D. o. A. E. D. a. (2020). [Online]. Gross Energy Generation and Purchase (by Type of Fuel). [Retrieved February 27, 2021]. http://www.eppo.go.th/epposite/images/Energy-

Statistics/energyinformation/Energy_Statistics/Electricity/T05_03_04-2.xls
Elrehail, H. (2018). The relationship among leadership, innovation and knowledge sharing: A guidance for analysis. *Data in brief*, *19*, 128-133. https://doi.org/10.1016/j.dib.2018.04.138
Elrehail, H., Emeagwali, O. L., Alsaad, A., & Alzghoul, A. (2018). The impact of Transformational and Authentic leadership on innovation in higher education: The contingent role of knowledge sharing. *Telematics and Informatics*, *35*(1), 55-67. https://doi.org/10.1016/j.tele.2017.09.018
Hong, J., Liao, Y., Zhang, Y., & Yu, Z. (2019). The effect of supply chain quality management practices and capabilities on operational and innovation performance: Evidence from Chinese manufacturers. *International Journal of Production Economics, 212*, 227-235. https://doi.org/10.1016/j.ijpe.2019.01.036
Ibrahim, M. Y. (2015). Model of Virtual Leadership, Intra-team Communication and Job Performance Among School Leaders in Malaysia. *Procedia - Social and Behavioral Sciences, 186*, 674-680. https://doi.org/10.1016/j.sbspro.2015.04.126
Martínez-Pérez, Á., Elche, D., & García-Villaverde, P. M. (2019). From diversity of interorganizational relationships to radical innovation in tourism destination: The role of knowledge exploration. *Journal of Destination Marketing & Management*, *11*, 80-88. https://doi.org/10.1016/j.jdmm.2018.12.002

May, G., Stahl, B., Taisch, M., & Kiritsis, D. (2017). Energy management in manufacturing: From literature review to a conceptual framework. *Journal of Cleaner Production, 167*, 1464-1489. https://doi.org/10.1016/j.jclepro.2016.10.191
Messeni Petruzzelli, A., Ardito, L., & Savino, T. (2018). Maturity of knowledge inputs and innovation value: The moderating effect of firm age and size. *Journal of Business Research, 86*, 190-201. https://doi.org/10.1016/j.jbusres.2018.02.009
Muthuveloo, R., Shanmugam, N., & Teoh, A. P. (2017). The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. *Asia Pacific Management Review*, *22*(4), 192-201. https://doi.org/10.1016/j.apmrv.2017.07.010
Naqshbandi, M. M., & Jasimuddin, S. M. (2018). Knowledge-oriented leadership and open innovation: Role of knowledge management capability in France-based multinationals. *International Business Review*, *27*(3), 701-713. https://doi.org/10.1016/j.ibusrev.2017.12.001
Office, D. o. E. P. a. P. (2018). "Guidelines for the preparation of the new power development plan of Thailand." Thailand's Power Development Plan (PDP) (2018–2037) *1*.
Schulze, M., Nehler, H., Ottosson, M., & Thollander, P. (2016). Energy management in industry–a systematic review of previous findings and an integrative conceptual framework. *Journal of cleaner production*, *112*, 3692-3708. https://doi.org/10.1016/j.jclepro.2015.06.060
Semuel, H., Siagian, H., & Octavia, S. (2017). The Effect of Leadership and Innovation on Differentiation Strategy and Company Performance. *Procedia - Social and Behavioral Sciences, 237*, 1152-1159. https://doi.org/10.1016/j.sbspro.2017.02.171
Shao, Z., Feng, Y., & Hu, Q. (2017). Impact of top management leadership styles on ERP assimilation and the role of organizational learning. *Information & Management, 54*(7), 902-919. https://doi.org/10.1016/j.im.2017.01.005
Silpcharu, T., & Noongam, W. (2020). The Second Order Confirmatory Factor Analysis Strategies toward Sustainable Excellence in the Industrial Sector. *Academy of Strategic Management Journal*, *19*(3), 1-10. https://www.proquest.com/openview/c8584869a302cfa8a9ad01f77c49a703/1?pq-

origsite=gscholar&cbl=38745
Thawornsujaritkul, T., Boonnual, C. (2017). "Guideline for Creative Share Value in Private Hospitals." International Journal of Economic Research. *14*(16), 521-528.
Wantanakomol, S. (2021). The effect of guidelines on reducing logistics costs. *Uncertain Supply Chain Management*, *9*(3), 667-674. http://dx.doi.org/10.5267/j.uscm.2021.5.003
Wongsapai, W. (2016). Performance Tracking of Thailand's Energy Management System under Energy Conservation Promotion Act. *Energy Procedia, 100*, 448-451. https://doi.org/10.1016/j.egypro.2016.10.200
Yıldız, S., Baştürk, F., & Boz, İ. T. (2014). The Effect of Leadership and Innovativeness on Business Performance. *Procedia - Social and Behavioral Sciences*, *150*, 785-793. https://doi.org/10.1016/j.sbspro.2014.09.064
Zhang, D., Rong, Z., & Ji, Q. (2019). Green innovation and firm performance: Evidence from listed companies in China. *Resources, Conservation and Recycling*, *144*, 48-55. https://doi.org/10.1016/j.resconrec.2019.01.023