
Creation of a knowledge management process in broiler production of Thailand

Injana, W.^{1*}, Phonpakdee, R.², Pongsuk, P.² and Petsangsri, S.³

¹Department of Agricultural Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand; ²Department of Agricultural Education; ³Department of Industrial Education, Faculty of Industrial Education, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand.

Injana, W., Phonpakdee, R., Pongsuk, P. and Petsangsri, S. (2019). Creation of knowledge management process in broiler production of Thailand. *International Journal of Agricultural Technology* 15(2): 273-286.

Abstract The Delphi technique is employed in this study to find an appropriate process of knowledge management in broiler production of Thailand. It is a specific agricultural knowledge management, which is different from other types of knowledge that are mostly accumulated knowledge gained from practice and problem solving. Different factors based on current situation are used to select an appropriate process with tacit knowledge management. It can aid problem solving in practice as the explicit knowledge can be transferred and connected to a method of cause analysis and thus address challenges related to broiler production. This helps develop the production system and knowledge transfer to benefit a new generation of animal husbandry practitioners. Results of the study show that the creation of the knowledge management process in broiler production involved seven steps: knowledge indication, knowledge creation and acquisition, knowledge codification and refinement, systematic knowledge management, knowledge access knowledge sharing, and learning process. A very high level of consistency in the value of opinions of specialists on knowledge management was found. Specific knowledge must be kept to construct innovative ideas for broiler production and development. This is to ensure safe food production and food security support, which results in sustainable production of safe meat.

Keywords: knowledge management, broiler production, sustainability

Introduction

Broiler domestication to produce chicken meat, which is a good protein food source, is important in human nutrition. Thailand is in a position to become the world kitchen in terms of geography, access to raw materials, and satisfying the needs of the country. Broiler production thus plays an important role in income generation and food security of the country (Parsertsak, 2012) and the world community in response to the high demand for food by the rapidly

*Corresponding Author: Injana, W.; Email: wuttikornsale2018stf@gmail.com

increasing world population (Injana *et al.*, 2015). Consequently, broiler production must be enlarged to develop the production system of agro-industry (Office of Agricultural Resources, Chulalongkorn University, 2017). This necessitates farmers or farm owners adapting themselves to become entrepreneurs. Also, they must add more animal husbandry technical workers and improve all aspects of animal husbandry. This will result in an effective operation of the animal husbandry farm that has the appropriate size. It is because broilers are economic animals having a rapid growth rate; feed conversion ratio can be observed after only 38-42 days of rearing. In other words, a newborn chick weighing 35-42 g will be mature and ready to be dissected when it reaches 2,800-3,200 g (Cobb-vantress, 2017a). Also, breeders can produce 166-182 chicks (Cobb-vantress, 2017b). There is thus a need for a body of knowledge and skills in broiler management to have good production control. This knowledge can be sorted into two: tacit knowledge and explicit knowledge at the ratio of 80:20 (Suanpleng, 2009; Sakroongposakul and Yuttananwiboonchai, 2006). Tacit knowledge is difficult to explain and transfer to other people (Namprasertchai, 2015); it is lost when people who possess it pass away. This loss affects the production system and have an impact on the sustainability of the business. Therefore, entrepreneurs give importance to process seeking and creation of a tool that can collect tacit knowledge and transform it into explicit knowledge that benefits the production process.

As knowledge management is a tool that can transform tacit knowledge into explicit knowledge, it is interesting to investigate what knowledge management process is needed for broiler production. This is a specific agricultural knowledge that can bring about production innovation and efficiency in the broiler industry.

Conceptual Framework of Study



Figure 1. Conceptual framework of study

Materials and Methods

Step 1. Review of related literature and Delphi technique to formulate conceptual framework about knowledge management.

Step 2. Specialist selection: one specialist obtained from purposive sampling; the obtained specialist proposes three otherspecialists and the three specialists propose another three specialists each (snowball sampling). The number of population having least classification error was 17 persons (Srinantawong, 2005; Khongkhanoi, 2010).

Step 3. Investigation step based on Delphi technique. Open-ended questionnaire was used for data collection, administered to 20 specialists. It involved the knowledge management process and various components of knowledge management. Obtained data were analyzed and synthesized and then used to construct a rating scale questionnaire to assess the appropriateness of knowledge management activities in each process. The rating scale questionnaire was then checked by five specialists. Other specialists considered consistency together with reason.

Step 4. Making conclusions based on consistency value. For items having low consistency (IR value range was 2.00-2.99), the specialist tries to get reasons by using an open-ended questionnaire; a discussion is then conducted.

The answers were used for the construction of a rating scale questionnaire, which was administered with the experts based on level of appropriateness of activities in each process (from most to least or from 5 to 1). Obtained scores of appropriateness were analyzed to find the median, mode, and interquartile range to interpret a level of consistency. Then, it was given to specialists for confirmation and evaluation of consistency of answers of other specialists. The following were the criteria of consistency:

Interquartile range	Answers of specialists
3.00 and above	= Have no consistency
2.00 – 2.99	= Low consistency
1.01 – 1.99	= Moderate consistency
0.51 – 1.00	= High consistency
0.50 and below	= Very high consistency

The accepted criterion at the interquartile range was between 1.01 and 1.99. This implies that answers of the specialists had moderate consistency.

Step 5. Final conclusions are made.

Results

Results of the study showed that more than half of the 20 specialists (75%) were female and that they belonged to age ranges 20-40 and 41 years old

and above (10 persons each). More than one-half (60%) were bachelor's degree holders and the rest had above bachelor's degree.

It was found that the 20 specialists had 12 issues in knowledge management: identification of knowledge needed for practice; acquisition of needed knowledge; improvement of knowledge to make it appropriate for practice; application of knowledge to be beneficial to practice; knowledge exchange; knowledge extraction for dissemination used in the organization; knowledge arrangement to be systematic; knowledge organizing; learning; and determination of the person responsible for the task. For data synthesis, seven processes of knowledge management were obtained: 1) knowledge indication, 2) knowledge creation and acquisition, 3) knowledge organizing, 4) knowledge management to be systematic, 5) knowledge access, 6) knowledge exchange, and 7) learning. All of these confirmed the findings of Gretsche *et al.* (2012).

Table 1. Knowledge identification process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Having a meeting to make clear conclusion about practice form	5.00	4.00	4.00	5.00	1	High
2	Explanation of tasks of each section	5.00	4.00	3.00	5.00	2	Low
3	Identifying sections that must work together	4.00	4.00	4.00	5.00	1	High
4	Formulating mutual mission	5.00	4.00	3.00	5.00	2	Low
5	Identifying clearly the needs of the organization	5.00	4.00	4.00	5.00	1	High
6	Having annual project planning every year	4.00	4.00	4.00	5.00	1	High
7	Preparing continual operational report	4.00	4.00	3.25	5.00	1.75	Moderate
8	Having conclusion about problems in practice after a task is finished	5.00	5.00	4.00	5.00	1	High
9	Having conclusion about factors that ensure successful task operation	4.00	4.00	4.00	5.00	1	High

Confirming the opinions of the specialist group, there was a high level of consistency in terms of 1) having a meeting to make clear conclusion about practice form—e.g., daily chicken health checking, checking amount of feed and water; 2) having needs told among sections that work together—e.g., making a record of dead chickens; 3) telling the organization about needs such as percentage of damage from broiler rearing, feed conversion ratio, and growth rate per head per day; 4) having annual project planning every year to come up with a calendar of chicken rearing for each production cycle and a calendar of pen break; 5) making conclusion regarding problems in practice after finishing tasks such as percentage of loss in each batch; and 6) making conclusions about

factors contributing to a successful task operation such as reporting of findings on each batch.

Table 2. Knowledge creation and acquisition process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Knowledge acquisition from specialists for use in practice	4.00	4.00	4.00	4.75	0.75	High
2	Coordination among various sections of the organization for mutual knowledge acquisition	4.00	4.00	4.00	5.00	1	High
3	Coordination from external organizations for new knowledge acquisition	4.00	4.00	4.00	4.00	0	Very high
4	Continual knowledge acquisition from staff in the organization	4.00	4.00	4.00	5.00	1	High
5	Staff acquiring knowledge through various media such as internet	5.00	4.50	4.00	5.00	1	High
6	Knowledge acquisition for practice	4.00	4.00	4.00	5.00	1	High
7	Acquiring existing knowledge in the organization for improvement of practice	3.00	4.00	3.00	5.00	2	Low
8	Seeking for specialists to institute practices in the organization	4.00	4.00	4.00	5.00	1	High

This confirmed the high level of consistency found by the specialist group: coordination from external organizations for new knowledge acquisition such as in-house seminars on biological safety system and farm sanitation; knowledge acquisition from specialists regarding practice; coordination among various sections in the organization for mutual knowledge acquisition; continual knowledge acquisition among organization staff such as fixing date and time for weekly meetings; and staff acquiring knowledge from various media such as internet, publications, etc.; and seeking for innovation in practice.

Table 3. Knowledge codification and refinement process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Continual review of practice steps	4.00	4.00	3.25	5.00	1.75	Moderate
2	Definition of terms and disseminating such throughout the organization	3.00	4.00	3.00	4.75	1.75	Moderate
3	Keeping knowledge in the same form	4.00	4.00	3.00	4.75	1.75	Moderate
4	Creation of a form of body of knowledge for the organization	5.00	4.00	3.00	5.00	2.00	Low

The specialist group found a moderate level as follows: continual review of practice steps; definition of terms and disseminating such throughout the organization; and keeping knowledge in the same form (e.g., making conclusions about problems in chicken rearing in each production cycle; preparation of reports on efficiency in daily chicken rearing; preparation of a farm news board; and establishment of similar groups for spreading farm news.

Table 4. Knowledge creation and acquisition process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Clear formulation of knowledge keeping structure in the organization	4.00	4.00	3.00	5.00	1	High
2	Clear policy formulation on knowledge keeping for use in practice and learning	5.00	4.50	4.00	5.00	1	High
3	Preparation of database on skills of staff in each aspect which is beneficial to systematic practice	4.00	4.00	3.25	4.75	1.50	Moderate
4	Preparation of knowledge acquisition system which is beneficial to work performance of staff	5.00	4.00	3.50	5.00	1.75	Moderate
5	Clear form of data collection used for practice and task transfer	4.00	4.00	3.00	4.00	1	High

Table 5. Knowledge access process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Continually inform the organization staff about knowledge access	4.00	4.00	3.00	4.00	1	High
2	Continually send data/information to organization staff	4.00	4.00	3.00	4.00	1	High
3	Construct website of the organization	5.00	5.00	4.00	5.00	1	High
4	Clearly prepare the organization unit for knowledge dissemination	5.00	4.50	3.25	5.00	1	High
5	Continually update data	5.00	4.50	4.00	5.00	1	High
6	Encourage participation in gathering and dissemination of data/information among organization staff	5.00	4.50	3.25	5.00	1.75	Moderate
7	Continually develop communication channels in the organization	5.00	4.50	3.25	5.00	1.75	Moderate
8	Continually call for meetings between administrators and organization staff or workers	3.00	4.00	3.00	4.00	1	High

A moderate level of consistency was found in terms of the following: clear formulation of knowledge keeping structure in the organization; clear policy formulation on knowledge keeping for use in practice and learning; and clear form of data collection for practice and task transfer. Examples were preparation of a manual on broiler production; formulation of a teaching method for new animal husbandry technical workers and chicken rearing staff; and clear designation of important tasks in data collection and management for broiler production.

The consistency level of opinions of the specialist group was found to be high based on the following: continually informing organization staff about knowledge access; continually sending data/information to organization staff; constructing the organization website; establishing the knowledge dissemination unit of the organization; continually updating data; and continuous conduct of meetings between administrators and organization staff.

Table 6. Knowledge sharing process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Engaging in activities to encourage organization staff to share knowledge	5.00	4.50	4.00	5.00	1	High
2	Preparing information to enable organization staff to learn and transfer knowledge to others in the organization	5.00	4.50	4.00	5.00	1	High
3	Creating networks for learning and transferring knowledge to others in the organization	5.00	5.00	3.25	5.00	1.75	Moderate
4	Creating networks for learning and transferring knowledge to others outside the organization	4.00	4.00	3.25	4.00	0.75	High
5	Presenting and sharing suggestions about practice among sections in the organization	4.00	4.00	4.00	4.00	0	Very high
6	Having meetings for learning and sharing of body of knowledge arising from practice	5.00	4.00	3.00	5.00	2	Low
7	Activities for knowledge sharing among various sections in the organization	4.00	4.00	4.00	5.00	1	High
8	Knowledge sharing from section heads and co-workers	5.00	4.00	4.00	5.00	1	High
9	Having a team for knowledge transfer and problem solving	4.00	4.00	3.25	5.00	1.75	Moderate

The following were found at a high consistency level: activities promoting organization staff to share knowledge; preparing information

enabling the organization staff learn and transfer knowledge to others in the organization; creating networks for learning and transferring knowledge to others outside the organization; activities for knowledge sharing of various sections in the organization; and knowledge sharing from section heads and co-workers. Examples are the conduct of meetings between teams of each section; making conclusions about the needs of concerned units in each section; preparing documents on practice objectives of each section; clear definition of tasks of each position and section; and clear preparation of success indicators for each duty.

Table 7. Knowledge learning process

No	Step in knowledge management	Mode	Mediun	Q1	Q3	IR	Level of consistency
1	Adoption of prepared knowledge in practice	5.00	4.50	4.00	5.00	1	High
2	Creation of innovation in practice	4.00	4.00	4.00	5.00	1	High
3	Practice development of sections	5.00	4.50	4.00	5.00	1	High
4	Having practice assessment of all sections	4.00	4.00	4.00	4.00	0	High
5	Having internal monitoring in the organization	4.00	4.00	4.00	5.00	1	High
6	Development of co-workers between sections	4.00	4.00	4.00	5.00	1	High
7	Integration of practice in the organization	4.00	4.00	4.00	5.00	1	High
8	Investigation and analysis between sections	4.00	4.00	3.00	4.75	1	High

Table 8. Level of consistency in the process of knowledge management in broiler production

No	Step in knowledge management	Mode	Mediun	IR	Level of consistency
1	Knowledge identification process	5	4	0	Very high
2	Knowledge creation and acquisition process	4	4	0.5	Very high
3	Knowledge codification and refinement process	4	4	0.5	Very high
4	Knowledge organization process	4	4	0	Very high
5	Knowledge access process	5	4.5	0.5	Very high
6	Knowledge sharing process	5	4	0.25	Very high
7	Knowledge learning process	4	4	0	Very high

The consistency level of opinions of the specialist group was found at a high level in terms of the following: adoption of prepared knowledge in practice; creation of innovation in practice; practice development of sections; having internal monitoring in the organization; development of co-workers between sections; integration of practice in the organization; investigation and analysis between sections; practice planning in the organization; and practice from preparation.

The consistency level of the entire process of knowledge management in broiler production can be deduced from data obtained from the specialists (Table 8).

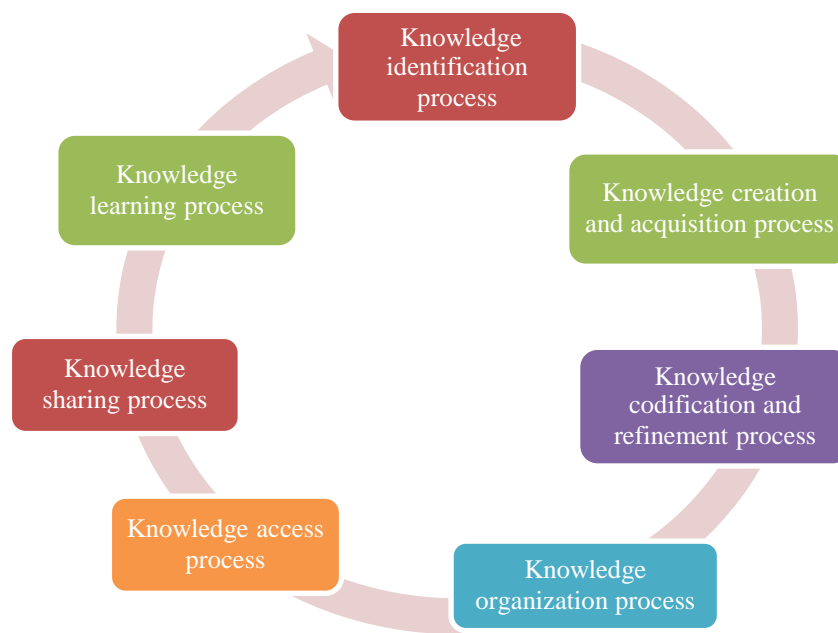


Figure 2. Process of knowledge management in broiler production

Discussion

The process of knowledge management facilitation consisted of seven steps: knowledge creation and acquisition, knowledge codification and refinement, knowledge organization, knowledge access, knowledge sharing, and knowledge learning. This may be classified based on the form of management in each process called the D.I.K. Model (Siemieniuch *et al.* (1999); Tian *et al.* (2009); Huei Tse Hou (2012); Rennolls *et al.* (2008). The model has three major parts:

Part 1. Data management process comprising knowledge identification, knowledge creation and acquisition, knowledge codification and refinement, and knowledge organization.

Part 2. Information management process comprising knowledge sharing.

Part 3. Knowledge management process comprising knowledge access and knowledge learning.

Therefore, knowledge management in broiler production is in the hands of individuals (tacit knowledge) and they use various information to turn this into explicit knowledge, which can be transferred to others in the organization. In other words, it can be used to create innovation in practice and thereby increase production efficiency. Interested farmers can benefit by following this model of knowledge management in broiler production.

1. Knowledge identification in broiler production. The Information Technology and Communication Center (2017) states that knowledge identification entails consideration of the target vision and mission and that, in order to achieve these, it is crucial that we know what existing knowledge we have, in what form, and with whom it resides. This conformed to the opinions of the specialist group, which were found at a high level of consistency in terms of having meetings for clear conclusion of practice form; identifying the needs of concerned sections; clearly showing organization needs; continual annual operational planning; making conclusion regarding problems encountered after finishing the tasks; and making conclusion about factors effecting a successful practice. For example, there was identification of broiler production elements: i.e., rearing form, number of chickens per area, live weight of broilers needed by the slaughter house, weight and size at each age, vaccination program, period of feed changing, time span of lighting in each period, setting a production goal for each batch, etc.

2. Knowledge creation and acquisition in broiler production. Choochan (2017) stated that this process involves creation and acquisition of knowledge from various sources dispersing inside and outside the organization. This aims to arrange the content of knowledge to meet the needs of the staff in an organization. This conformed to opinions of the specialist team, which were found at a high level of consistency on the basis of the following: coordination from external sources to acquire new knowledge and find existing knowledge in the organization. The following were activities having a high level of consistency: acquiring knowledge from specialists for use in practice; coordination among various sections of the organization for knowledge acquisition; continual knowledge acquisition for co-workers in the organization; staff of the organization acquiring knowledge from various

sources; and seeking for innovation for use in practice. These entail continuous training on knowledge about broiler production management; presentation of various innovations; and support on data source creation.

3. Knowledge codification and refinement in broiler production. Pasukyud (2007) identifies this process as improvement of documentary form to meet standards, language use, and content of knowledge. This conformed to opinions of the specialist group which were found at a moderate level of consistency on the basis of the following: continual review of practice steps; defining terms related to practice and disseminating these throughout the organization; and arranging the same knowledge for future use. For example, there were conclusions made regarding problems encountered in each batch. Moreover, there was preparation of daily/weekly broiler rearing forms and news dissemination boards; a dissemination group was likewise set up for news/information sharing.

4. Knowledge organization in broiler production. A study by the faculty of Pharmaceutical Science, Ubon Ratchathani University (2010) revealed that knowledge organization involves laying out a knowledge structure for systematic knowledge keeping in the future. This conformed to opinions of the specialist group which were found at a high level of consistency on the basis of the following: formulation of a clear structure of knowledge keeping for use in practice. Examples included the preparation of a manual on broiler production for new animal husbandry technical workers and designation of data collection tasks for broiler production.

5. Knowledge access in broiler production. The Office of Public Sector Development and the Thailand Productivity Institute (Office of the National Research Council of Thailand, 2003) revealed that knowledge access is to make knowledge users gain easy access to information technology system, web board, and public relations board. This conformed to opinions of the specialist group, which were found at a high level of consistency based on the following: continually giving knowledge access to staff in the organization; creation of organization website; establishment of an agency for knowledge dissemination; continual update of data; and regular meetings between administrators and workers.

6. Knowledge sharing about broiler production. Noiwat (2011) claimed that the knowledge sharing process involves management of a cross-functional team, group activities on quality and innovation, learning community, escort system, task shifting, knowledge sharing venue, etc. This conformed to opinions of the specialist group, which were found at a very high level of consistency in terms of sharing suggestions about practice between sections in the organization. The following were found at a high level: activities

encouraging organization staff to share knowledge; preparing information to enable the organization staff learn and transfer knowledge to others in the organization; and knowledge sharing between heads and co-workers. Examples were holding meetings between teams of each section; assessing the needs of each section; preparing a document on the objectives of each section; clearly defining the tasks of each position and section; and clearly identifying success indicators.

7. Knowledge learning about broiler production. It is the adoption of knowledge for problem solving, improvement, and development of work performance. Problems encountered must be discussed for improvement of procedures and assessment of practice must be done. This conformed to opinions of the specialist group, which were found at a high level on the basis of the following: application of knowledge to practice; creation of innovation for practice; development of work performance; internal assessment; practice development between sections; practice integration in the organization; investigation and analysis of practice between sections; creation of practice plan in the organization; and creation of common practice.

Conclusion

This study aimed to seek guidelines for future practice in order to reduce conflicts among specialists with respect to broiler domestication. This study showed that the knowledge management process in broiler domestication comprised seven steps: 1) knowledge identification, 2) knowledge creation and acquisition, 3) knowledge organizing, 4) knowledge management to be systematic, 5) knowledge access, 6) knowledge exchange, and 7) knowledge learning. All of these processes had a high level of consistency. This could help animal husbandry workers develop efficiency in broiler production. This would result in decreased production cost and creation of innovative ways to further improve the broiler industry. Besides, this body of knowledge could be transferred from senior animal husbandry workers to beginners. In fact, the learning process or the development of knowledge management on broiler domestication could happen in every step, depending on the experience, problem solving ability, and knowledge management skills of each animal husbandry worker.

References

Choochan, J. (2017). Developing Competitive Capability of Broiler Industry for Export under the Coordination of Public and Private Sectors. *Econ. Animal J.* 798:42-49.

- Cobb-vantress (2017a). Breeder Management Supplement Fast Feather Female. Retrieved from <https://cobb-guides.s3.amazonaws.com/a71b8bc0-bbd4-11e6-bd5d-55bb08833e29.pdf>.
- Cobb-vantress (2017b). Broiler Performance and Nutrition Supplement. Retrieved from <https://cobb-guides.s3.amazonaws.com/f5ec4cd0-bc92-11e6-bd5d-55bb08833e29.pdf>
- Gretsch, S., Mandl, H. and Schatz, R. (2012). Implementation Process of a Knowledge Management Initiative: Yellow Pages. Ludwig-Maximilian-University, Germany. www.intechopen.com.
- Huei Tse Hou (2012). New Research on Knowledge Management Models and Methods. Taiwan: National Taiwan University of Science and Technology.
- Information and Communication Center (2017). Process of Knowledge Management. Retrieved from http://network.moph.go.th/km_ict/?p=392.
- Injana, W., Intrarathet, S., Phonpakdee, R. and Pongsuk, P. (2015). Knowledge Management Adoption of Animal Husbandry on Broiler Farms in Western Thailand. *J.Agric. Technol.* 11: 2295-2300.
- Khongkhanoi, M. (2010). Policy and Guidelines for Promoting Practice of the Culture Council of Thailand. Unpublished dissertation, Silpakorn University.
- Namprasertchai, S. (2015). Knowledge Management. Retrieved from http://www.psdd.doae.go.th/05_KM/02-KM-2.pdf.
- Noiwat, O. (2011). Knowledge Management. Online Health subject manual. Sukhothai Thammathirat Open University. Retrieved from <http://www.stou.ac.th/Schools/Shs/booklet/book544/km.html>.
- Office of Agricultural Resources, Chulalongkorn University (2017). Sufficiency Agriculture or Agro-Industry. Retrieved from <http://www.cusar.chula.ac.th>.
- Office of the National Research Council of Thailand (2003). Manual on the Preparation of Knowledge Management Plan. Bangkok: Office of Public Sector Development and Thailand Productivity Institute.
- Parsertsak, W. (2012). Concept and Food Security. Retrieved from <http://www.polsci.tu.ac.th>
- Pasukyud, P. (2007). Knowledge Management. Bangkok: Yai Mai Printing.
- Rennolls, K. and Abdallah Al-Shawabkeh. (2008). Formal Structures for Data Mining, Knowledge Discovery and Communication in a Knowledge Management Environment. *Intell. Data Anal.* 12:147-163.
- Sakroongposakul, S. and Yuttananwiboonchai, J. (2006). System of Information and Knowledge Management Technology Bangkok: C-Education.
- Siemieniuch, Carys E. and Murray A. Sinclair. (1999). Organizational Aspects of Knowledge Lifecycle Management in Manufacturing. *Int. J. Human-Computer Stud.* 51:517-547.
- Srinantawong, D. (2005). Demonstration School of Silpakorn University. Unpublished thesis, Silpakorn University.
- Suanpleng, P. (2009). Information Technology and Innovation for Knowledge Management. Bangkok: C-Education.
- Tian, J., Yoshiteru N., and Wierzbicki, A. P. (2009). Knowledge Management and Knowledge Creation in Academia: a study based on surveys in a Japanese research university. *J. Knowledge Manage.* 13:76-92.

Ubon Ratchathani University (2010). Concept and Steps of Knowledge Management Plan Preparation (KM Action Plan), Fiscal Year 2010. Faculty of Pharmaceutical Science. Retrieved from <http://www.phar.ubu.ac.th/km/?p=197>.

(Received: 8 November 2018, accepted: 28 February 2019)