ENHANCEMENT OF FIVE DISCIPLINES UNDER PETER SENGE'S APPROACH FOR COMMERCIAL PILOT BASED ON KNOWLEDGE MANAGEMENT

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Abstract: The commercial pilot is a person who has duty and responsibility on safety of all passengers and crews. The development of necessary characteristics of commercial pilots becomes the vital issue that all airlines must be aware of and take any action. According to the study, it was found that important characteristics which help commercial pilots to perform duties effectively are five disciplines under Peter Senge's Approach. As a result, this research focuses on seeking the approach of five disciplines development for commercial pilots based on the approaches of Knowledge Management, Anticipatory Learning and Appreciative Inquiry. The researcher applied the model of enhancement of five disciplines to 17 commercial pilots and spent 62 days for testing. The obtained model consists of six components, which are 1) Airlines core policy, 2) Personnel, 3) Airline data, 4) Knowledge management activity sheet form, 5) Learning and communication tools and 6) Performance development plan. It is comprised of six procedures as follows; 1) Reviewing policy and data, 2) Pursuing visions, 3) Seeking for experience learning, 4) Creatively developing performances, 5) Examining and reflecting alternatives and 6) Maintaining knowledge for airlines.

Keywords: The Five Disciplines, Knowledge Management, Peter Senge, Commercial Pilot.

Introduction

Since 2011, there is the Open Skies Policy in Thailand for aviation liberalization with all nations. As such, the freedom of the air that Thailand is entitled to such routes is unlimited. Airlines of related countries fully have the freedoms of the air. Therefore, Thailand has to promote Thai private airlines to use such freedoms of the air as well. There are many new private airlines launched, resulting to strong competition in the aviation industry. Airlines attempt to adapt themselves and use strategies to their organization management for survival. The development of personnel becomes one

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of the main factors in strategies of airlines, especially commercial pilot, who is the most important person of each flight. To develop pilots to be knowledgeable, skillful and experienced in aviation operations is the most significant issue that all airlines cannot ignore. In other words, they have to enhance the efficiency of such development.

Pilot is major personnel because commercial pilots have direct responsibilities and the highest authority in controlling airplanes. In case of emergencies, pilots are responsible for any actions that make all passengers and crews safe on the airplane they control, similar to the phrase "The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." (FAA Federal Aviation Regulations (FARS, 14 CFR) Part 91 Section 3, 2014).

Development of commercial pilot can be performed in several methods, like the development of personnel in organizations, such as Training by lecturers, Simulations Practice, Field Study, Action Learning, and E- training, etc. The development with such methods can promote pilots to have knowledge and skills in operation at a certain level. However, global famous and leading airlines search for strategies to support aviation personnel, especially their commercial pilots, to develop characteristics which help cause the sustainable development to personnel. For example, Southwest Airline of United States applies "the Power of Relationships to Achieve High Performance" strategy (Gittell, 2003) by creating the environment that offers opportunities to pilots for 1) shared goals 2) shared knowledge and 3) mutual respect. There are three types of communication technique, which are 1) frequent communication 2) timely communication and 3) problem-solving communication. The result of such strategy causes pilots of Southwest Airline to work cooperatively rather than to be sole responsibility, resulting to the high success to the airline. In the meantime, Singapore Airlines applies five leadership strategies in aviation industry by innovating cost-effective and service excellence. Two strategies applied by Singapore Airlines are Empowerment of frontline staff to control quality and Successful service delivery team. (Wirtz, Heracleous and Pangarkar, 2008)

According to the characteristics of pilots, it represents that the important characteristics of five disciplines are applied as the approach for basic characteristics of commercial pilots. The development of five disciplines based on Peter Senge's approach will result to the operations development of commercial pilots to be efficient according to the core policy of airlines. It may say that pilot is the profession that requires systems thinking and decision skills for effective operations. In addition, it was also found that five disciplines were applied as the operational approach of pilots, such as, Mental Model is used to summarize the understanding before the flight so that all pilots will have the same visions and ideas because humans will take an action according to their mental models, resulting to understanding and operations (Jones, 2010).

Cropper (2004) cited that the development of five disciplines must be performed simultaneously. All characteristics cannot be developed separately but they require concurrent development. Some confirmed that the development of five disciplines could be performed by knowledge management process (Anderson, 2004; Albers and Brewer, 2003; Davidson and Phillip, 2002; McElroy, 2000; Probst and others, 2000; Marquardt, 1996). Knowledge management refers to the process of identifying

knowledge, building knowledge, sharing knowledge, arranging knowledge system, storing knowledge and conveying knowledge among commercial pilots to obtain new knowledge for performances development. Commercial pilots are able to apply knowledge efficiently and perform operations according to the goals of airlines through appropriate technologies and activities (Tckhakaia, Cabras & Rodrigues, 2015). In this research, the researcher applied the following knowledge management process; 1) Identifying knowledge is the step of participation in tracking internal useful knowledge of organizations (Edwards, 2011), 2) Building knowledge is the step of integrating new sources of knowledge (Alavi and Leidner, 2001), 3) Sharing knowledge (Bouthillier and Shearer, 2002) is the step of participation in conveying knowledge from one individual to another one or more individuals, 4) Storing knowledge is the step relating to knowledge storing and information management for better understanding and knowledge (Bouthillier and Shearer, 2002) and 5) Conveying knowledge is the activity aiming to adapt obtained knowledge to be appropriate to personnel and information dissemination methods which are useful for everyone (Parikh, 2001).

It is not sufficient to apply only the knowledge management to the development of five disciplines. Other appropriate strategies are also required to be integrated into such development. The researcher found that Appreciative inquiry and Anticipatory learning can be used to develop personnel together with knowledge management (Senge, 1990).

Kelm (2005) said that "Appreciative inquiry provides a basic way to approach for positive change by finding the best in personnel in order to co-creating inspiring future images focusing on what we want". Pullen (2001) cited that Appreciative inquiry is the best search which helps motivate imagination of what is going to happen". Regarding commercial pilots, appreciative inquiry refers to the process of searching for the best experience or knowledge of pilots which enhances positive competence and capability of pilots and airlines by mutually analyzing situations and tendency of airlines, creating visions of problem-solving, building excellent competence to airlines, promoting all commercial pilots to develop their competence and supporting airlines to achieve specified visions.

Fulmer (1992) defined the Anticipatory Learning as the emphasis of future and participation rather than considering what has done in the past by trying to predict creative solutions to problems and potential problems. Bingham and Kahl (2014) defined the Anticipatory Learning as the integrated process of backward-looking and forward looking which focuses on changes in the cognitive level as well as changes in behaviors. Regarding commercial pilots, Anticipatory Learning refers to the learning process of pilots from successful and unsuccessful pasts in order to review the cause and problem-solving methods appropriately, acquire aspects of problem analysis and learning process from commercial pilots and surrounding situations by reflecting thoughts together and applying them to solve proactive and creative problems.

The purpose of this study is to develop and propose the model of knowledge management for enhancing five disciplines for commercial pilots. The study attempted to provide evidence that the Knowledge Management Model using an

appreciative inquiry and anticipatory learning is an effective model for commercial pilot to develop the five disciplines based on Peter Senge's approach.

Research Method

In this research, the researcher used a combination of a survey research (the five disciplines analysis), a development research (the Model Design and Construct) and an experimental research (the five disciplines measurement).

The Five Disciplines Analysis

Participants

The five disciplines necessary for commercial pilots based on Peter Senge's approach were collected through in-depth interview from five executives in the president level and department director level of Thai Airways International Company (Limited) and Bangkok Airways Company (Limited). The eight questions used to explore what are behaviors of commercial pilots underlined the five disciplines based on Peter Senge's approach. The findings from this step helped the researcher to make a scale for measuring the five disciplines of commercial pilots.

Results

The data obtained by the in-depth interview revealed that within five disciplines, there were 31 characteristics and 105 behaviors. The researcher concluded the characteristics and behaviors as follows:

1. Personal mastery refers to the characteristic and behaviors that promotes commercial pilots to have clear personal vision which corresponds to the visions of airlines, leading to operations for achieving the success of airlines, to be patient and handle with any obscurity and change, to be energetic, seek for learning and commit to the specified goal.

2. Mental models refers to the characteristic and behaviors that promotes commercial pilots to understand themselves and their airlines, leading to the change of operation behaviors, values, individual attitude, to distinguish what to believe and what to act, to search for beliefs and ideas, leading to challenges, to expand scope and thinking process as well as individual beliefs, and to understand others' aspects and thinking.

3. Shared vision refers to the characteristic and behaviors that promotes commercial pilots to create goals of airlines together with other pilots, mutually developing future image of airlines, and setting goals, missions that promote good values in operations and become the operational approach for pilots to achieve specified goals.

4. Team learning refers to the characteristic and behaviors that promotes commercial pilots to adapt concepts, practices and commitment of the team to be in the same direction, to have commitment to develop the capability of the team for creating results that all members truly need. It is the mutual learning of members by exchanging knowledge and ideas of members in the group for developing knowledge and skill of the team and good coordination.

5. Systems thinking refers to the characteristic and behaviors that promotes commercial pilots to have ability in visioning overall picture, analyze and make a decision systemically and immediately, predicting and seeing relevant relations, leading to big picture consistently, to effectively link and forecast any events affecting operations.

The Model Design and Construct

Participants

In order to design the knowledge management model for enhancing five disciplines for commercial pilots, the researcher collected the based-line data from 292 commercial pilots. The size of sampling group was calculated by G*Power which had the medium effect size (effect size = 0.25) and the error value was 0.05. Two hundred and ninety two commercial pilots with more than five years of experiences were from Thai Airways International Company (Limited), Bangkok Airways Company (Limited), and nine international airlines**.** They were reflected their professional development, their experiences with knowledge management, an appreciative inquiry-based learning and an anticipatory learning. The 47 questions in checklist form and 5 Likert-scale was delivered to participants by the researcher. The data were analyzed and integrated with principles and concepts used to design and construct the components and procedures of the model.

Results

1. The knowledge management model using appreciative inquiry and anticipatory learning to enhance five disciplines for commercial pilots based on Peter Senge's approach consists of six components.
    - 1.1 Airlines core policy
    - 1.2 Personnel
    - 1.3 Airlines data
    - 1.4 Knowledge management activity worksheet
    - 1.5 Learning and communication tools
    - 1.6 Performance development plan
2. Procedures of training consist of six procedures and 42 steps:
    - 2.1 Reviewing policy and data: Project Orientation, Assess Self-characteristic, Clarify Airline fact and data, Review airline goals, Select group members by policy, Suggest knowledge base, Recommend Websites, Tryout Websites, Assign roles and duties, Design knowledge exchange methods, and Motivate group members.
    - 2.2 Pursuing visions: Analyze experiences, Identify knowledge, Exchange experiences, Propose approach, Create personal vision, Analyze tendency, and Create co-visions.
    - 2.3 Seeking for Experiences Learning: Identify knowledge, Search for knowledge, Analyze causes and practices, Summarize and store knowledge, Outline individual performance development plan, and Inspect final plans

2.4 Creatively Developing Performances: Apply knowledge, Record experiences, Exchange experiences, Propose problems, Analyze and revise plan, Outline co-performance development plan, and Inspect plans.

2.5 Examining and Reflecting Alternatives: Reflect knowledge, Review visions, and Co-summarize plans, store knowledge, and Disseminate knowledge

2.6 Maintaining knowledge for airlines: Review and adjust plans, Assess action plans, Assess characteristics and behaviors, Approve plans, and Disseminate knowledge in group.

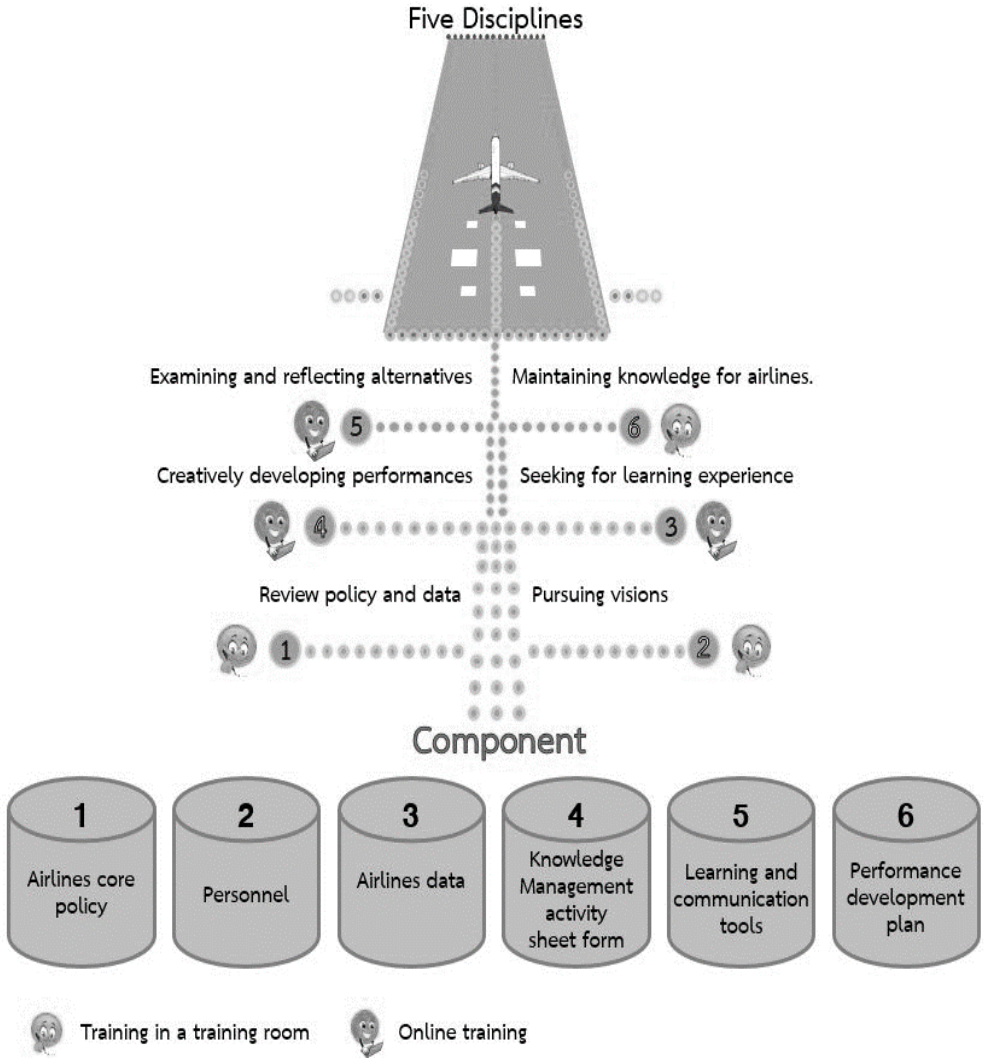

Figure 1: The Model of Enhancing Five Disciplines for Commercial Pilots Based on Peter Senge's Approach

The Five Disciplines Measurement

Participants

The sample group used in the test of the knowledge management model by using Appreciative inquiry and Anticipatory learning to enhance five disciplines for commercial pilots based on Peter Senge's approach was 17 pilots who had more than five years of aviation experiences of Thai Airways International Company (Limited). They were selected from the population using purposive sampling technique by selecting commercial pilots who were interested and willing to participate in the program.

The study utilized an experimental design known as one group Pre-test and Posttest design. The researcher conducted an experiment with one selected group of pilots using a self-assessment as a measurement done before applying the Knowledge management Model and measuring after. The researcher divided the participants into four groups based on willingness. They engaged in the study for 62 days. In order to assess the behaviors change in the five disciplines, participants, co-members, and three bosses completed 360-degree assessment at the end of the study. Moreover, to confirm characteristics developed during creating the performance development plan, the five executives of Thai Airways International Company (Limited) assess the plans from four groups whether the characteristics of the five disciplines were developed by pilots who participated in the study.

Results

1. Scores on the pre-test and posttests provided an assessment of participants' five disciplines. Table 1 shows the mean and standard deviation of these test scores for the experiment group. There were significant differences between pre-test and posttest scores. The mean of the posttest score is higher than pre-test scores in all five disciplines.

Table 1: Comparison Pre-Test and Posttest for Participants in Five Disciplines

Five disciplines	Pre - test		Post - test		t - test	sig
	Mean	S.D.	Mean	S.D.		
1. Personal Mastery	2.57	0.05	4.01	0.12	50.42	0.000
2. Mental Models	2.70	0.09	3.99	0.08	43.82	0.000
3. Shared Vision	2.59	0.08	3.95	0.11	42.49	0.000
4. Team Learning	2.48	0.07	4.04	0.11	59.88	0.000
5. Systems Thinking	2.50	0.05	4.13	0.07	70.96	0.000
Average Scores	2.57	0.07	4.03	0.10	53.51	0.000

2. Scores on the assessment of performance development plan of the four groups provided the developed characteristics and behaviors of participants during the 62 days of activities based on the Knowledge Management Model. Table 2 shows the scores of the four groups. It shows that Group 1 gained highest average scores with highest scores in Personal Mastery and Group 4 gained lowest scores.

Table 2: Comparison Score of Each Group from Performance Development Plan Assessment

Five disciplines	Scores			
	Group 1	Group 2	Group 3	Group 4
1. Personal Mastery	96.67	88.33	90.00	81.67
2. Mental Models	91.67	90.00	88.33	85.00
3. Shared Vision	93.33	90.00	88.33	86.67
4. Team Learning	88.33	85.00	88.33	85.00
5. Systems Thinking	93.33	86.67	85.00	83.33
Average Scores	92.67	88.00	88.00	84.33

Discussion

In this paper, the researcher have presented results from an empirical study that aimed to determine the quality of the Knowledge Management Model by using appreciative inquiry and anticipatory learning to enhance five disciplines for commercial pilots based on Peter Senge's approach. The study has shown a detailed Model and a positive effect for Knowledge Management, confirming that Knowledge Management with appreciative inquiry and anticipatory learning can enhance five disciplines for commercial pilots. In particular, the study has revealed a significant components and procedures in the model. The selected discussed are as follows:

1. The first significant component of the model is the Airline Policy since it reflects the objectives and directions that executives and personnel in organization use as the goal of operations (Wamundila, 2008). The Airline policy is applied as the framework for pilots to set goals and visions which will lead the Airlines to the specified goal effectively. The second component is learning and communication tools. The commercial pilot is the career that requires 24-hour operations and operation time is different according to their assigned flight. Therefore, technology is the tool for exchanging experiences effectively (Nikravan, 2011). Mostly the communication among commercial pilots is asynchronous due to the nature of work. Accordingly, learning and communication technology plays an important role in storing and collecting knowledge. Importantly, it helps the formulation of the plan achieve successfully although their operations are different. The commercial pilots in this study reflected that learning and communication technology is their major tool as shown in the conversation through web board as follows;

"Yes, we have different free time but if we share information here, it is really good."

"It is the web board that everyone can share experiences."

"Each person has different free time but they can search for information and share it here".

2. One of the major step is the Pursuing Visions. This step the commercial pilots has to create their co-visions used as the goal to develop their performance. In such step, the characteristic for creating co-visions will occur which lead to the involvement of achieving the sane goal. Commercial Pilots has to analyze their airline comprehensively, identify needed knowledge corresponding to policies, build image required in performance development plan, propose operation approach

corresponding to policies, and examine and analyze future tendency of airlines for better understanding. (Senge, 1990; Song and Chermack, 2008). In addition, the characteristic and behaviors for commercial pilots for creating co-visions will occur in the stage of performance development innovation as well because pilots outline the plan together. In such stage, it causes the development of five disciplines. Pilots have to apply knowledge to operations, record operation experiences, exchange knowledge, learn, analyze and find solutions to problems and mutually propose operation methods applied to the outline of performance development plan which are useful to operations according to the airlines' policies (King, 2009).

3. The mean of the posttest score of participants is higher than pre-test scores in all five disciplines. These results suggest that the Knowledge Management Model has a significant effect on commercial pilots' five disciplines.

3.1 The step of Creatively Developing Performances can highly develop 6 characteristics of Personal Mastery since it is the step that commercial pilots exchanged and learned by applying knowledge to the formulation of performance development plan. It results to the self-development in problem management, knowledge enhancement and application of knowledge to adjust and improve the performance development plan so that they are able to perform operations and achieve the goal mutually specified and corresponding to the airlines' policies (King, 2009).

3. 2 The step of Seeking for Experiences Learning can highly develop 7 characteristics of Mental Models because it is the step that commercial pilots seek for experiences and search for needed knowledge to develop their performance plan from the success of other pilots who have expertise and success in Best Practice, and then share experiences, in-depth data, knowledge and skills, seek for facts and opinions to be used as the foundation of systemic analysis and thinking. They apply comprehensive data to inspect ideas, express opinions, accept different comments and assess situations before operations so that they can identify the root cause of problems and adjust and improve the performance development plan correctly (Armstrong & Foley, 2003).

3.3 The step of Pursuing Visions can highly develop 6 characteristics of Shared Vision since it is the stage that commercial pilots co-create vision by determining their visions corresponding to tasks, which are clear and practicable, through the discussion leading to the involvement of the same goal, seeing different problems and applying new approaches to solve problems in order to find approaches corresponding to the airlines' policies, and determining framework for performing missions together (Yeo, 2005).

3.4 The step of Examining and Reflecting Alternatives can highly develop 4 characteristics of Systems Thinking since it is the stage that commercial pilots inspect performance development plans together, review personal visions and visions of airlines and adapt original visions, reflect knowledge from co-learning, summarizing knowledge, arranging category and order of knowledge to see the big picture systemically, sorting the priority of procedures and providing the structure based on the performance development plan outline (Joshi, Sarker and Sarker, 2006).

3.5 The step of Creatively Developing Performances can highly develop 4 characteristics of Team Learning since it is the stage that commercial pilots exchange and learn for collecting new knowledge and maintain original knowledge and exchange knowledge, leading to co-learning from application of knowledge in outlining performance development plans, and also develop efficiency of performance development plans corresponding to objectives and policies of airlines (King and Marks Jr.,2005).

4. To allow pilot to create their performance development plan can reflect five disciplines because it represents that 1) pilots outline the plan by considering airlines' policies and the plan leads to successful operations as the specified goals, which reflects Personal Mastery, 2) The plan has details showing that members of the group use various ideas to analyze data, search for thoughts and beliefs in operations to acquire data for formulating the plan, which reflects Mental Models, 3) In the preparation stage, members of the group help create visions that represent the goal setting of airlines for outlining the plan, leading to the clear picture of the plan, which reflects Shared Vision, 4) There are details in the plan showing that members of the group help develop the action plan in the same direction for required results, think and take action together leading to various ideas, which reflects Team Learning, and 5) There are details in the plan showing that members of the group consider factors related to operations, link and predict situations possibly affected by operations and think comprehensively based on the procedures of the plan, which reflects Systems Thinking (Gagne, 2009).

Recommendation

1. Any commercial airline should considered the selection of pilots into the program. The developed model based on Knowledge Management approach, so the experienced commercial pilots are required. Their experiences, especially best practices are necessary in the step of exchange experiences, propose approaches and analyze tendency which will lead to vision creation, including the step of share experiences and in-depth data. Commercial pilots who have less experiences will not be able to develop high quality of performance development plan.

2. We need a further research that develops a Knowledge Management model for commercial pilots in three levels: new pilot, co-pilot and experienced pilot. The commercial pilots with different experiences have distinct aviation skills and knowledge, including the application of knowledge and experiences to the performance development plan. Therefore, the new model should be designed with appropriate and different activities.

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