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THE APPLICATION OF MIND MAPPING IN MAINTENANCE KNOWLEDGE MANAGEMENT AND SHARING IN PRACTICE

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ABSTRACT

The knowledge and experience regarding to maintenance management of government department in Taiwan are hard to be shared because of confused sources of law and the frequent transference of engineers. This study applied mind mapping to enhancing knowledge management (KM) performance in the construction project. Combined with mind mapping, this study proposes a Mind Map Knowledge Management (MMKM) approach to help engineers to reuse and share knowledge and experience. The proposed MMKM enables engineers to illustrate and share their experience with other engineers. Engineers are, thus, invited to exchange and share their knowledge from their experience. Mind mapping not only has a user-friendly interface, but also can annotate the main point by chromatic labeling tool. The user can also connect to cut-and-dried files or search the relative public information through the Internet by clicking a keyword or an import figure in the mind mapping. The mind mapping could help users generalize and manage the knowledge and experience among people. Moreover, senior and junior engineers can effectively and easily exchange knowledge and experience regarding a specific aspect of their current construction project. The MMKM approach is then applied in selected pilot test of a government department in Taiwan to verify our proposed approach in practice. The combined results demonstrate that the advantage of the MMKM approach not only in improving KM work efficiency, but also in facilitating easy identifying code knowledge and knowledge relationship integrated with mind mapping. Final suggestion and limitation are identified and discussed for further related applications.

Keywords: knowledge management, KM, mind mapping, construction management.

1. INTRODUCTION

The maintenance management is constrained by the unique conditions of the site. So it's hard to systematize the steps of the maintenance management. And the manger often makes policy by his work experiences. However, the explicit knowledge of maintenance management which is distributed over complex laws is hard to be integrated; the frequent changes of duties result in a

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failure on sharing and exchanging the implicit knowledge. So it's necessary to establish a complete knowledge management system to assist manager in integrating his work experiences. Mind mapping not only has simple theory but also has a user-friendly interface. User can easily manage the knowledge and experience by colors, lines, figures, hyperlinks, and the Internet on the user-friendly interface. This paper shows a mind map of maintenance management to display the explicit and implicit knowledge of maintenance management of government department concretely and establishes a mechanism to pass down the knowledge and experience. Then it also takes a true case for example to confirm the feasibility of the mechanism. Finally, it analyses the benefit of this mechanism, and the suggestion and limitation are identified and discussed for further related applications.

2. LITERATURE REVIEW

Buzan (1970) developed mind mapping and extensively used it in thinking and learning. And the mind mapping had ever been used in education. For instance, Anthony et al. (1999) highlighted the specific applications of mind mapping in a variety of contexts based on executive education and in management development consulting. Martin (2006) made a comparison between concept maps, mind maps, conceptual diagrams, and visual metaphors as complementary tools for knowledge construction and sharing and indicated that the different visualization formats could be used in complementary methods to enhance motivation, attention, understanding and recall. Kokotovich (2008) empirically investigates and discusses why non-hierarchical mind mapping tools are useful as design tools for first year industrial design students and illustrates how non-hierarchical mind mapping techniques can guide novice designers in adopting the design problem-solving processes/framework of expert designers.

3. METHODOLOGY

This research introduces a method for drafting a mind map of maintenance management and a mechanism for passing down the knowledge and experience with mind mapping of maintenance management.

3.1. The method for drafting a mind map of maintenance management

The method for drafting a mind map of maintenance management could be divided into two procedures. One is about the information collection and organization; another is about the establishment of mind map.

The method of the information collection and organization procedure is in according with the procedure of maintenance management in the department of government. It divides the maintenance management into eight executive phases, including requirement, evaluation, decision-making, procurement, performance, acceptance test, payment, and warranty. And the eight executive phases

are taken as the first extended main topics of the mind map of maintenance management around the central topic, maintenance management.

After confirming the basic structure of the mind map, we could comprehensively list and collect the information about the work or other related knowledge during the period of each executive phase and summarize the information into the work events and the respective instructions of them. The work events are taken as the sub topics of the respective main topics according to the respective executive phases, and the instructions are taken as the illustrations of the respective work events. Similarly, we could also take the executive steps of the respective work events as the branches of the respective sub topics and extend the scale of the mind map.

The establishment of mind map in this research could be integrated as a six-step procedure in Fig. 1. The establishment principles are as following: (a) Establish the mind map from the central topic to the sub topic based on the degree of the topic. (b) Arrange the topics in a clockwise or anti-clockwise direction according to the time sequence for letting the mind map easier to understand. (c) Mark the topics after arranging all the topics for avoiding the misunderstanding of the logic of mind map.

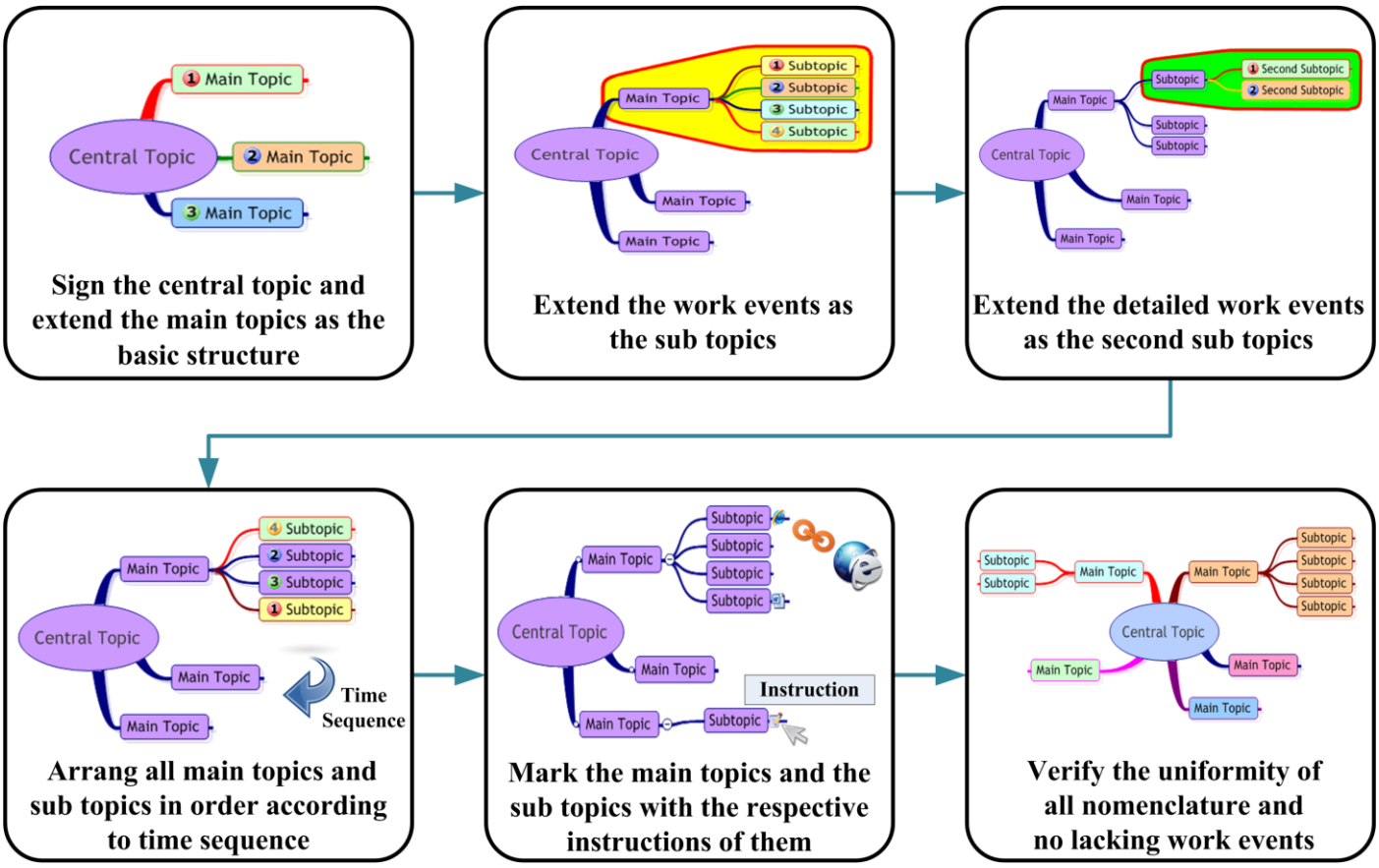

Figure 1: The establishment step of mind map of maintenance management

3.2. The mechanism for passing down the knowledge and experience

The mechanism for passing down the knowledge and experience with mind mapping of maintenance management also could be divided into a preceding work and a repeating procedure. The preceding work is the establishment of mind map of maintenance management introduced in previous section. Once an experienced person establishes a mind map of maintenance management, the user will be able to execute the maintenance management in accordance with the mind map and replenish the mind map with his new experience. This research defines the repeating activity of updating the information as Cycling Feedback and Revise Procedure (CFRP).

4. CASE STUDY

The proposed case is about an experienced engineer really establishes a mind map of maintenance management in Fig. 2 and let a freshman execute the maintenance management in accordance with the mind map by himself. Then the experienced engineer interviews the freshman and proposes the suggestion of modifications. Finally, the research analyzes the benefits and problems of mind mapping and compared with present method.

This example is about a flooded pavement under ground between two buildings because of the over inflow of rainwater. In this case, the professional construction company recommends two formulas. One is to block the path of seepage; the other is to deflect the stagnant water. Because of the uncertain locations of seepage, the first formula not only spends much money but also contains too much risk. Conversely, the second formula is nothing about the unknown causes, and it can also save money and minimize the risk. So we choose the second formula to solve the problem in this case.

The freshman thinks the mind map of maintenance management could help him to know the executive steps of maintenance management, but it doesn’t show the definitions of proper nouns. So he still can’t complete execute the maintenance management by present mind map. And it also can’t provide the information about how to obtain the assistance in the aspect of his work.

For improving the mind map, the user proposes two programs to modify the mind map. First, in order to reduce the condition that too many proper nouns confuse the freshmen, the designer should adopt the accessible words to compile the mind map and set up a link between the proper nouns and the respective illustrations. Because of the uncertain coverage of maintenance engineering, it’s hard to confirm the related managers and coadjutants. So the compiler also suggests adding a regular list of related managers and coadjutants for fast searching. These suggestions will be taken for the reference for compiling mind map in the future.

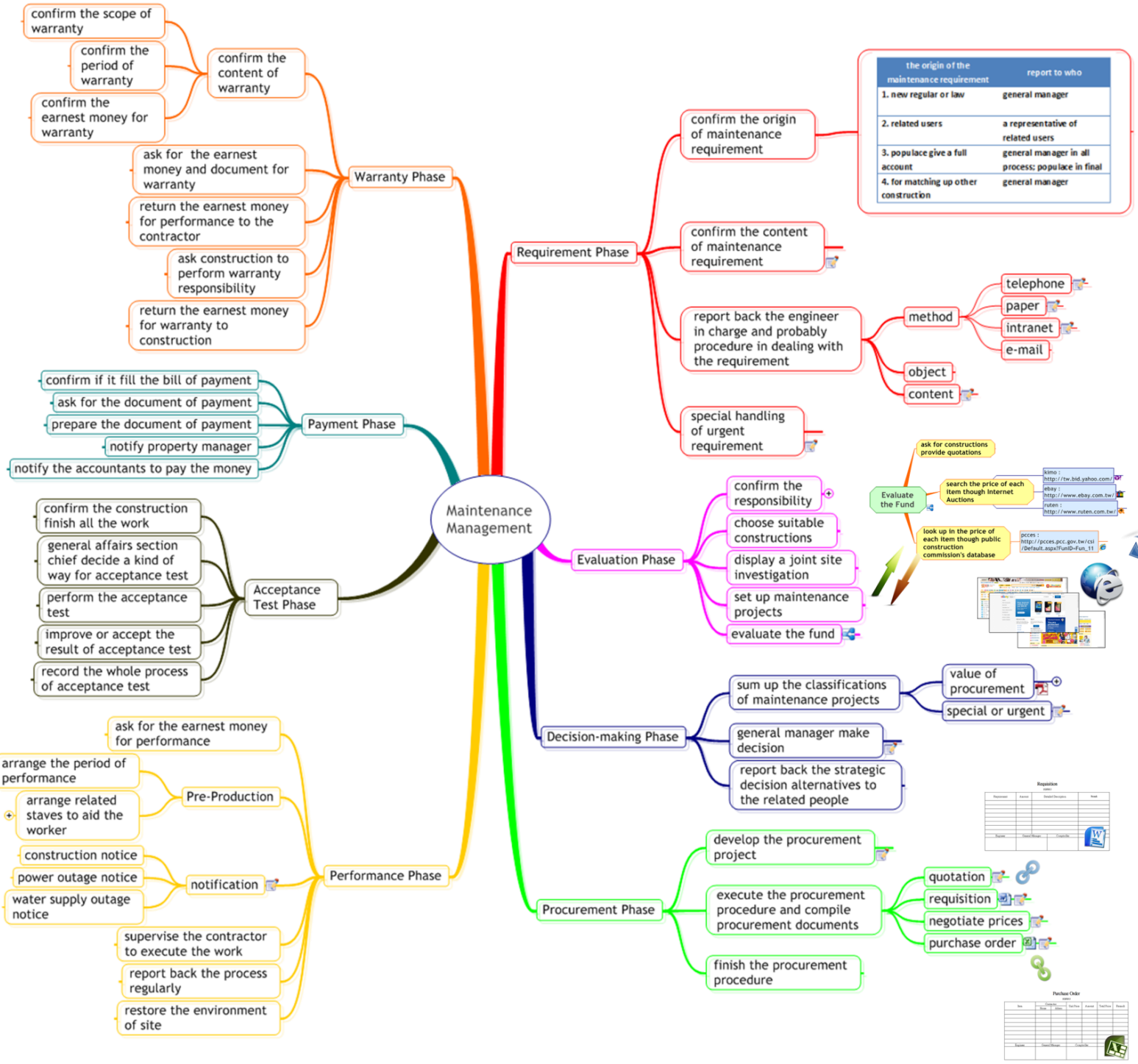

Figure 2: The mind map of maintenance managemet

In this case, we could find if the knowledge would be easy to be passed down based on the presentational form of knowledge. So this research proposes three recommendations to create a clearer and more regular user interface of the mind map.

The first recommendation is to unify the properties of events belong to the same level as much as possible. Because the users can't know the logic of the complier through the branches of mind map, we should increase the logicality of mind map. This method can enhance the relationship of the branches on the level and make the users understand the mind map readily. In this case, the main topics are the eight procedures of maintenance management; the first sub topics are the works of the respective procedures; the second sub topics are the details of the respective works. This self-constituted rule also make the compilers can compile the mind map much more easily.

The second recommendation is to compile the events in time sequence for increasing the correlation between each event. Because of the radiant thinking of mind mapping, there is no referable rule to arrange the events. So we could make the mind map more regular by compiling the events in time sequence. And this also helps the compiler to complete the mind map without skipping any necessary work.

The last recommendation is to close the unwanted branches to simplify the user interface of mind map when executing maintanence management with mind mapping. Because every branch of mind map could be considered as the detailed description of the branch on the previous level, not all branches have the direct relation with each other. So the user could reduce the intake of the disturbed data and control the scale of interface of mind map.

Through this case, we could find two advantages of mind mapping in maintenance management. The first advantage is that the instructions of mind map could remind the freshman of many detailed actions which often could improve the consummations of maintenance management. The other advantage is that the mind mapping could supply users a huge amount of checkpoints to help them do an overall check-up. Those advantages could assist a user to execute maintenance management step by step without omitting any important events.

This research analyzes the advantages and shortcomings of proposed method and compares with present method which is often applied to KM in Table 1.

Because of the conservative value, it's hard to apply a new technique or method in the department of government. In another aspect, although the mind mapping is really useful for a freshman, there is still less benefit for an experienced engineer to enhance the efficiency of passing on the knowledge and experience. So the engineer of the department of government also has no incentive to execute the CFRP. After synthesizing the above reasons, we believe that there are still many difficulties needed to be overcome in applying mind mapping to maintenance management of the department of government.

Table 1: The comparison of present method and proposed method

	Present Method (SOP)	Proposed Method
If there are strict logical relationships between each of work events?	The complier must establish strict logical relationships between each of work events through arrows.	The complier just clssify the work events and array them in time sequence without establishing strict logical relationships.
If the complier could remark the inportant words by packages?	The complier could remark the words, set up hyperlinks with figures or files, and connect to Internet by packages.	The complier could remark the words, set up hyperlinks with figures or files, and connect to Internet by packages.
If the global figure could be easily divided into several local figures?	Because of strict logic between each of work events, the arbitrary division of SOP figure may destroy the completeness of SOP figure.	A global mind map could become a local mind map by closing some branches without any subsidiary method or tool.
The easiness of understanding the information through the interface	Because of complex and strict logical relationships, SOP is hard to be understood for the user.	The user could easily get the information which he wants to know from the local mind map without thinking complex logical relationships.
If the user could modify the figure easily?	The user must understand the procedure clearly before modifying SOP figure. Otherwise, he or she may make a wrong change.	The user just needs to know basic concept of mind mapping, and then he or she could modify the mind map.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

After establishing a mechanism of maintenance management with mind mapping and discussing the problems through a true case, the following conclusions are made:

1. Because of supplying freshmen complete information about the whole workflow of maintenance management, the mind map of maintenance management is really useful to pass down the knowledge and experience of maintenance management.
2. Comparing with the large scale of the present method of maintenance management, the mind map of maintenance management could supply a user the adequate information under a scope which is adopted much easier for users. So the mind mapping of maintenance management is more advantageous than present method.
3. Because of the low acceptance of new method and lacking an inducement for engineers of government department, it’s hard to use mind mapping in maintenance management.

5.2. Recommendations

This paper also proposes the recommendations as follow:

1. When compiling a mind map, the editor should try his best to unify the properties of events belong to the same level and to compile the events in time sequence for increasing the correlation between each event.
2. This research presents a unidirectional and one-to-one mechanism to pass down the knowledge and experience, and the future research may examine the feasibility of bilateral and many-to-many mechanism through cloud computing.

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