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Research paper



The Implementation of the Levenberg-Marquardt for Continuous Improvement of the Management System for BPK PENABUR Education Foundation in Jakarta

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Abstract

Improving the quality of the management system for schools that have several branches requires a big commitment from executor to managerial. By using the Levenberg-Marquardt education system concept that belongs to 15 branches, it is divided into 5 subsystems and 3 layers. The subsystems are in the form of learning dynamics, organizational transformation, human development, knowledge management and technology applications. Layer 1 is the managerial rank in each branch, the second layer is the leader as the first validator to be forwarded to the third layer, which is the head office with the final decision at the top of BPK Penabur organization. The improvement of management system starts from the gap between each subsystem that has been agreed as the standard. All components covering the secretariat (administration), Principal, Deputy Principal (student, curriculum, Facility SBI), teachers, librarians and laboratory assistants were the subjects responsible for the improvement of the management performance. While the president director and organization leader are the last layer that determines the better changes that is run. After being done gradually and continuously, the gap occurred is decreasing. By reducing the gap, the performance of the management at BPK PENABUR school can become better

Keywords: *Levenberg-marquardt, Management Organitation, School Organitation.*

1. Introduction

An organization absolutely requires a harmonious relationship to keep a system run properly. This is a reciprocal process by involving all resources both external and internal factors [1]. For education organizations, the success of a management will develop the perspective of the related organization, where in general, the community's assessment is based on outcomes (student graduates). So, it is common for us to hear favorite and non-favorite school. In general, community will see a process of school management that optimizes internal resources to produce high-quality graduates. The absence of quality improvement will give a negative assessment and ultimately will be detrimental to the sustainability of an organization[2-5].

Many methods are introduced to improve management performance, for example a problem-based model encountered in a managerial. This model has an advantage of being able to understand the existence of a gap in management [6]. In addition, this method can easily classify based on the form or source so that the settlement can be done based on the field. However, the method of performance improvement of a problem-based management also has weaknesses, namely: when it comes to problems with a great complexity, the resolution has less focus; it is difficult to find a priority of the problem solving. The next drawback: when finding a gap where the source of the problem is not verified properly, the settlement can also be ineffective.

The method of improving performance of an organization based on customer satisfaction has been developed by Lilia Dvorakova and Olga Faltejskova [7], in her research, the problem that must be overcome from the results of a management, came from the level of customer satisfaction measurement. This model was very effective for a product whose goods were received directly by consumers. But when it will be applied to increase the performance of an organization for education, there is no explanation about it.

Another model is the application of ISO 9001 on quality management systems to improve management performance. In general, the performance improvement methods that apply ISO 9001 has data structures with high level of order. This happens since the assessment of each data structure is based on strict standards. As it has been investigated by Helgi Thor Ingason [8], the ISO 9001 implementation could be applied to various sectors such as consultants, contractor, production companies, IT companies to schools. In its practice, the application of ISO is a solution that puts commitment in the implementation process. The necessary commitment is continuous because it is used as a guarantee for the next process. This model is very effective, but when an organization has a quality that is far below the standard, the application of ISO 9001 will be difficult.

The Levenberg-Marquardt model can also be used as a process for improving a management. Although in general, this model is commonly used for a machine learning that has certain intelligence[9]. As it was done by Hossein Mirzaee [10] where the Levenberg-Marquardt had been implemented the learning algorithm with a neural network approach. The input was in the form of data processed from the hidden layer to get output in the form of a motion prediction sensor. The similar thing was also done by Marcin Kaminski and Teresa Orlowska-Kowalska [11] for trained controllers. This model was really helpful for mechanical model learning, which required a continuous training. Different from a research done by Andriy Sabaraka et al. [12], the Levenberg-Marquardt algorithm was used for trained unmanned aerial vehi-

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cles. In its implementation, the authors emphasized training to improve the ability of a sensor. The training process was carried out continuously by adding iteration to get an optimal process[13]. In implementing the Levenberg-Marquardt algorithm for management, data input and processes must be carried out in a structured manner. In accordance with the concept, the improvement is made by applying training to elements that have non-optimum conditions. In this study, the application of the Levenberg-Marquardt concept for a management working in education can be explained in the sub-chapter below.

2. The Levenberg-Marquardt Application

Social culture development in the community requires the education system to develop and keep updated with the newest era. It gives an opportunity for the development by adopting an innovation of management. By implementing the Levenberg-Marquardt, the subsystem is divided based on management standards at BPK PENABUR school. The performance improvement is done gradually and continuously with validator in the form of the first layer until the top management as the second layer. In order to improve the management system, especially educational organization can be done as it is shown in Figure 1:

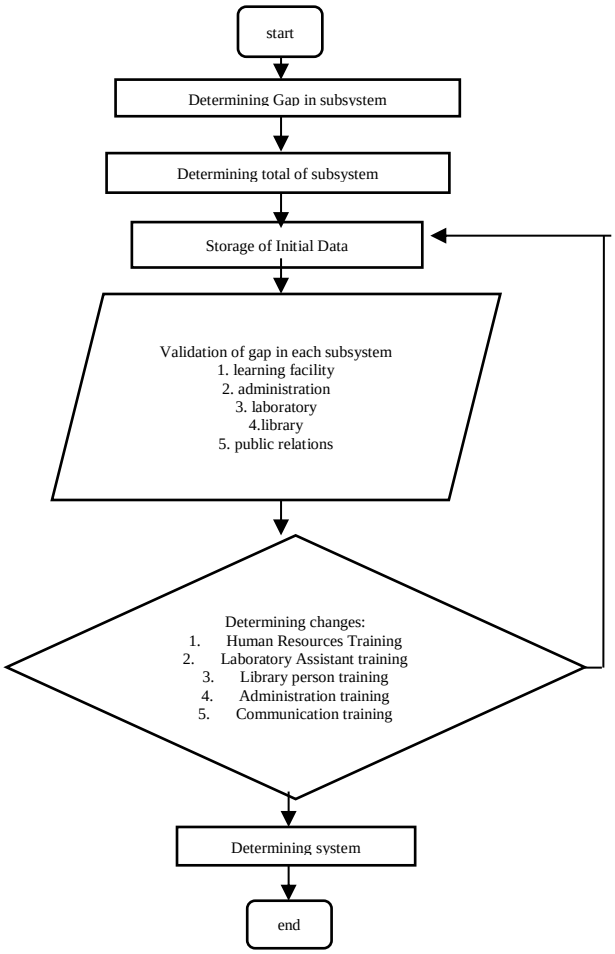

Fig. 1 flow chart of the research

The Levenberg-Marquardt system is a system created to balance human intelligence in determining a step or an action. Where this system is able to adapt and have sensitivity to data. Artificial neural network technology is started from input in the form of stimulus, then, each stimulus is included in a process to process data. And the last process in this method is decision making. The decision taken in this method is the result of improvements from the initial data stored. The network in this mode was trained with certain patterns that form a process. Hence, the model and process could change based on the character improvement. If there was a big gap between the data entering toward the specified standard, the iteration process by repetition is carried out continuously.

In the application of artificial neural methods as in Levenberg-Marquardt for continuous improvement, it begins by recognizing gaps or problems that arise in a single flow of activities. By adding validation of a problem, all components in one organization existing in BPK Penabur can be correctly identified. This is related to learning and teaching facilities, administrative facilities, laboratory, library and communication fields outside of school. From each gap where the truth is already validated, the changes in improvement in the first layer can be carried out by the leader of each sub-system. Improvement by adding training for the field of skill and adding the required equipment can also be generally accepted after being set as a policy by the central leader from the result of changes. When an ideal concept has not been found, improvement can be continued to be done to achieve an ideal condition**.**

The activation function in this model used a liner function where each decision from the leader would be applied parallel to the entire system. This model is expected to become a standard that can later facilitate in finding inequality or gap.

3. Result and Discussion

Improvements are used as a method of reducing the gap that occurs in the running subsystems. The fundamental differences are improved by improving quality. The Levenberg-Marquardt concept is widely applied for a continuous learning. This model starts the process by receiving input in the form of stimulus where input stimulus is received by neurons, which later interact each other to form a process. Information suppliers can be empowered as the first phase process because this channel functions to strengthen or weaken data input. The information is then processed in a cell that functions as a process for the second phase, which is then determined as the effect of a process.

The initial data on each subsystem is recorded as data 0 or named as information 0 and then passed through the channel to layer 1. The second layer is the hidden layer which is the processing of the incoming information from the hidden layer that gives out the information to the second layer as the outer layer. This outer layer is the place of decision making in the form of results. This can be described as follows in Figure 2.

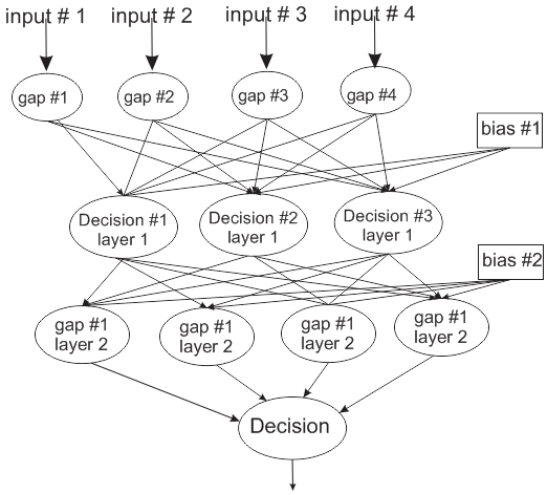

Fig. 2: Neural network design

In the picture above, there is a bias that is used as the weight of the information multiplier to layer 1. (layer 1). Weakening or weakening of information or data was presented in this phase. While the second bias was the second weight that transmits information from the first data. In this phase, there will be also weakening and

strengthening of data. Then the results of this data were simulated into a policy product set by leader. The structure of applying the Leverberg-Marquardt was intended for the management of BPK Penabur as follows (see figure 3)

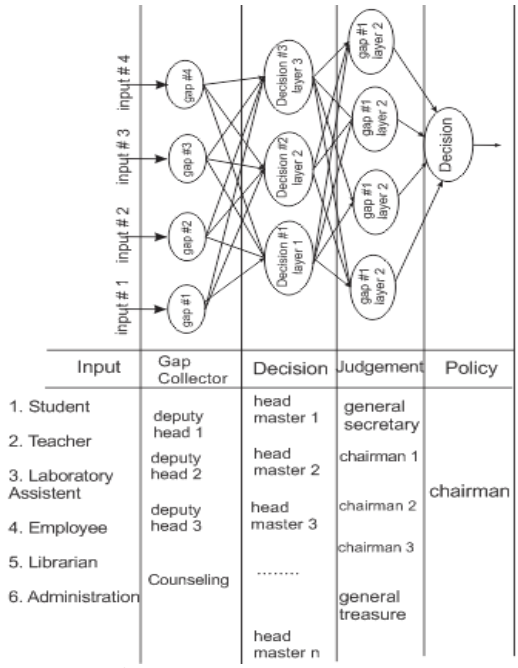

Fig. 3: simulation of the Levenberg- Marquardt application model for BPK PENABUR management

Each element of the system was responsible for the data so that validity of the output in the form of data whether through layer 1 or layer 2 could be accounted for. During the learning process in the form of training data sets, the learning outcomes will continue to be processed as an initial data to create conditions that stop such learning process.

When there was a gap, the gap between components in organizational management was divided into 2 groups. The first group was in the form of gaps related to physical components, while the second group was related to skills. In this model, the continuous improvement can be done as it is shown in table 1 below

Table 1 grouping the gap in BPK Penabur organization

NO	Gap Specification	physical	skill
1	Bench for learning	√	..
2	Interactive board	√	√
3	Internet connection	√	..
4	Chemical laboratories	√	√
5	Library book	√	..
6	Bulletin board	√	..
7	Data storage	..	√

After the group related to the problem found was identified, the information was passed to the first layer with the process to solve the problem. In the first layer, the decision in the form of additional infrastructure, replacement and training for operators were processed. When it happened, the administration evaluated and recorded the data properly which later reported to the central organization. Central management could process this information as an input when this input was information 0. Regional Improvement could be done. Whereas, if it is a whole input, then the information could be processed for the second layer with the final decision from BPK PENABUR leader. In Figure 4. is an example of information related to a library. In the information, regarding skill of librarian and equipment for the library are processed from layer 1 managerial to the top management

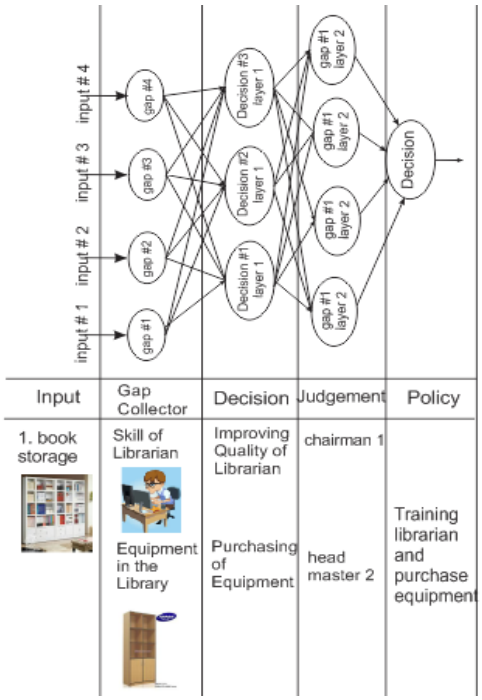

Fig. 4: Solving the gap from layer I to layer II

In the picture above, there is a continuous process that occurs in each subsystem to central management when a gap only occurs in the subsystem and can be completed up to layer 1. Then the output from the first layer is the latest data by reducing the gap (for example: purchase equipment for library). As it is shown in Figure 5 below.

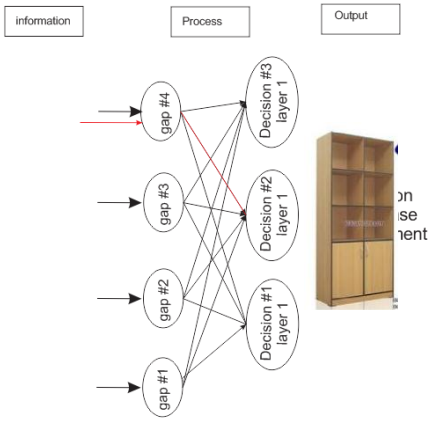

Figure 5: completion of the gap to layer 1

Whereas, if it is related to skills, the identified gap can be in the form of information whose the intensity of the gap can vary. When this happens, the information received from the system can be forwarded and processed up to layer 1 and continued to layer 2. This model will produce a solution in the form of skill enhancement, i.e. general training. Therefore, the results obtained by the general training will produce uniform competencies. Completion of the gap in the form of skill enhancement can be done repeatedly until the desired competence is fulfilled. When the competencies generated in the first training are insufficient, the next training with different levels of competencies must be done as illustrated in Figure 6 below

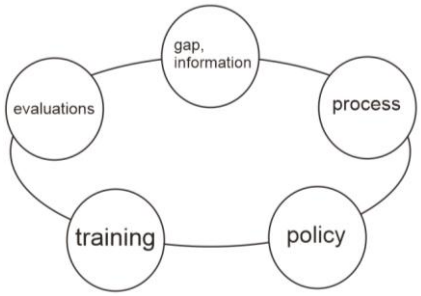

Figure 6: solving the gap in the form of skills

When the completion either in physical or skill can be carried out gradually and continuously, organizations with subsystems in the form of human resources, namely teachers, employees, laboratory staff and librarians, as well as infrastructure needed in the learning process can be improved.

4. Conclusion

In applying the concept of the Levenberg-Marquardt to improve the performance of educational organizations, it requires identification of problems with real time and well-structured. Data that are real time can be forwarded into information that will be processed as a decision. The decision at layer 1 is regional while the overall decision is a decision that is made as a joint policy. Gap can be identified based on 2 groups whose resolution model can be adjusted according to the existing conditions. By applying this concept, BPK PENABUR organization will be more solid and has high performance

From this study, the use of Levenberg-Marquardt evaluation can be applied well to educational organizations so that continuous improvements can be made in both physical and skill forms.

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