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Expert System Software for Production Planning and Quality Control in Bleaching Dyeing and Finishing Process of Textiles Industry

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Abstract. The objective of this research is to develop the expert software to use for planning the production process and quality control. Starting from collecting the data of knowledge, and expertise experiences, to analyze, design, tests and record in systematic ways. By using the forward chaining inference and knowledge acquisition subsystem, writing with SQL and developing by Oracle to work on Unix server and exporting through Microsoft Excel for the convenient working. Process and decision procedures show after feeding the data into the system, for estimation and sending the results to program page. According to the set up pattern, experts spend 60 minutes for a piece of work manually. After introducing this system, experts are able to reduce time consumption by 98.33 %. Previously they spend 45 minutes/120 yards to check of fabric. Time consumption is reduced 55.55%, this means the increasing production result of 3,072 yards/day and the average cost is 61,440 baht/day. The investment is paid back within 26 days. This system can be used without experts who have estimation experiences. It does not need any specialized persons. This is the way to preserve the knowledge and solve the problems which may occur at the workplace. It is the foundation for managing the value added production system to be stable and sustainable.

Introduction

Nowadays there are lots of expert systems and they were used as applied methods in many different fields. These systems have the abilities to do the functions the same as human experts who give the advices as well as knowledge and various experiences that were transferred to the system permanently [1]. Researchers have the concepts to bring the mentioned systems to apply in production planning and quality control. This improvement should not increase the workload and decrease the data delay [2]. Reducing workload, increasing more correctness and exactitude in every part of work which use the same data[3]. Reducing the failures of data and time consumption in working procedures [4]. At present the production process is not able to produce the products for delivering to customers on due time [5]. Deficiency of good information technology system for planning and production control [6], the process starts from the production process study, using intellectual resources to find out the causes, analyzing the deficiency characters and the responsive effects of production process [7], the development of the program is to speed up the factory working process to be faster and more efficient [8], the system helps to get the correct results which are precise, and it is close to the analysis of human experts. This shows the expert system which has been developed to be efficient. Also the expert system can be used for training or reviewing the knowledge of users [9]. The grading program on this expert system focuses on design which is according to the regulations and demands. It can be applied to match the requests conveniently by analyzed method, design, development tests and corrective improvement to be perfect. It is based on some factors such as the correctness, trustworthy and the convenience of users [10]. Industrial plants are able to improve the work process and increase the production for the organizations successfully; therefore the efficiency of competition is risen, ready to become the leader in industrial circle locally and abroad in the future.

Methodology or Procedure

1. Analysis and setting the frame of problems from the old system, in terms of production process and quality control. This must focus on problems of technical procedures.

2. Design and collecting data information which is related with the analytical problems [11]. They are separated in two parts, the one which is used to evaluate the knowledge from the knowledge base; another part is used to communicate with the users [12]. The mechanism to inference is the software which is able to inference the work with causes and reasons. The software of the expert system uses the knowledge base and data information which users can reach the new knowledge [13]. Because of planning for the production process and quality control has the condition of step by step procedure which is suitable for the forward chaining inference and knowledge acquisition subsystem for explaining how the system works.

3. To complete the system development, researchers select to use the SQL which is the language for managing database. This is able to save time for system development, no license cost, it is saved and it is sure that there is no virus because it is updated all the time. It is stable and does the fast operation. The system is able to connect with networks and computers that have different hardware. It can be used with all operation systems, as well as for multi-user and multi-tasking [14]. By developing the database program Oracle to work on Unix Server, to do filing and it is the knowledge base of expert system for using as the tool to check the correctness, sorting, finding breadth answers.

4. Testing the system operation.

5. System installation and research conclusion.

Result

1. Design steps of Expert System

To design the data base of knowledge, experts have to set up the conditions for planning production process and quality control (See Fig.1)

2. Program Development of Expert System

Researchers select to use the language SQL for developing working process in the parts of forms creation, reporting by developing database program Oracle to work on Unix server, including program pages can be exported via Microsoft Excel. This is convenient for working.

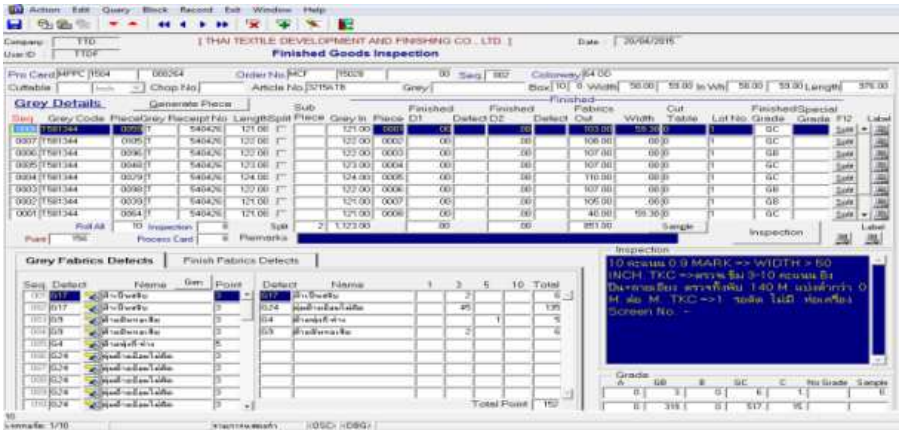

Fig.1 Program page of quality control

3. Testing the working process of the system

Testing the correctness of the system, ten experts joined the testing and evaluated the planning production part. They picked up 30 sampled problems and also 20 experts examined 80 pieces of garment to do the quality control. This is to test and compare the results between the analysis of experts and using data analysis tools program on Microsoft Excel (Table 1). This program supported to do the evaluation, it is the program which is easy to find and comfortable to use [15].

Table 1 The comparisonbefore and after planning program

Planning No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Before	60	59	51	60	55	50	59	45	60	67	59	60	59	60	50	59	63	57	59	69	63	57	59	60	58	59	50	59	42	59
After	1	2	1.5	2	1	1	2	1.25	1	1.3	2	1	1	1	1	1.5	1	1	2	1	1.25	1	1.25	1	1	1.5	1	1.5	2	1

The result of F-Test Two-Sample for Variances is 1) P(F <= f) one tail = 1.0009 comparison with the significant factors, this is morevaluable than the operation before and after using the Expert System for production planning are the same. 2) From the value F = 237.298 compare with the value Of Fcritical one-tail = 1.882. This shows the result that F value is more than F Critical one-tail, therefore the hypothesis is not accepted. This means the variations before and after operation are not the same. 3) According to the results of testing, the values of variation before and after operations are not the same. Therefore, the test to see the differences of average values before and after the operations must be done, by using t-Test: Two-sample Assuming Equal Variances which the hypothesis is $H_0 : \mu_1^2 = \mu_2^2$ and $H_0 : \mu_1^2 \neq \mu_2^2$ μ_1^2 and μ_2^2 are used for before and after operating the Expert System for planning the production process accordingly.

Discussion

To test the working of the Expert System with the experts of the company which is the case study, measuring the working time of each activity, report the errors, correctness, comparison before and after the improvement.

Table 2 The comparison before and development

	Production Plan			Quality Inspection		
	Before	After	Result	Before	After	Result
Time : 1 Job	60 min	1 min	98.33%	45 min	25 min	55.55%
Time : Condition	37 step	1 step	97.30%	3 step	1 step	66.67%
Accuracy	100	100	100%	100	100	100%
Free of error	100	100	100%	100	100	100%
Acceptability	100	100	100%	100	100	100%
Time : Condition	37 step	1 step	97.30%	3 step	1 step	66.67%

Table 3 Estimation the worthiness of the investment

Operation method	Cost of making the Expert system for quality control		
Investment	**Equipment investment**	**Amount**	**Value (Baht)**
	Computer	10 unit	300,000
	Printer	2 unit	90,000
	Installation and wiring	1 job	150,000
	Software investment		120,000
	Oracle license	10 client	7,500
	Program writng	90 day	900,000
	Total investment		**1,567,500**
Compensation	Total production increases 3,072 yds/day	20 baht	61,440 baht/day
	Time frame of pay back after implementation of the expert system		**25.51**

From Table 2, it shows that experts manage the planning of production process manually by using their experiences. Time spending is 60 minutes/work.After using the Expert System, experts are able to reduce time spending for checking the fabric 55.55%, thus the production rate increases 3,072 yards/day which the average cost is 61,440 Baht/day. This can estimate the income value of investment that the pay back is 26 days, as shown in table 3.

Conclusion

Expert System is developed to increase the efficiency and effective results for the determined users. Each decision is similar and no conflict. Users only select what they want on the system, the results come out instantly. If they want to follow the production or doing the quality control, they can enter the system and press the buttons, making the selections which they are interested to view, they need not to specify the conditions. The system supports the knowledge in figures and report various movement according to the demand of users. This decreases the necessary to rely on extra individuals and preserve the knowledge which may lose when qualified employees resign. The data is qualified and efficient to use at any time. It is the strategy to do marketing, reducing the cost and improving the products innovation.This system can help to solve the problems at work. It is the

foundation for managing the production process with value added and it is sustainable.For further research, this Expert System can be used without expertise person and it reduces the time consumption for estimation. The system calculates precisely to match with all decided regulations by introducing the multiple functions and it is the system which can revise the previous knowledge of experts and concerned persons

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