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A Study on the Degree of Technology Accumulation Management for the *R & D* Manpower

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ABSTRACT

The efficient management for the research and development (R&D) manpower will absolutely be necessary for the successful accomplishment of R&D projects. In this respect, a methodology through analyzing and evaluating the degree of technology accumulation was presented, using the INGRES Data Base Management System (DBMS) in UNIX operating system.

I. INTRODUCTION

The growth of organizations is dynamic. In analyzing the managerial status of such organization, they should always attend to the fact that the organization should enhance its performance ability by enforcing the internal organization power, as responding sensitively to their changing circumstances.

Especially, R&D organizations should maintain their optimal states of functions to accomplish the given projects successfully. In estimating the R&D organizations, almost all of the researchers consider the manpower the most important factor, because it is indispensable for the R&D activities. In this respect, a method to analyze and manage the degree of technology accumulation for the R&D manpower is considerably emphasized.

The degree of technology accumulation can be defined as "a comparative measure that one research group or one researcher can accomplish the given projects successfully in a given period."

The objective of this research is to present a method to analyze and evaluate the degree of technology accumulation as a means for the R&D manpower management.

II. EVALUATION MODEL

II-1. Procedure

The procedure for the degree of technology accumulation management can be summarized as follows:

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(1) deciding the relevant factors and the evaluation model
(2) gathering and analyzing the basic data
(3) selecting the appropriate software and constructing the data-base system
(4) deriving and analyzing the degree of technology accumulation
(5) establishing the management system for the continual evaluation
(6) suggesting a method to enhance the degree of technology accumulation

II-2. Evaluation model

The degree of technology accumulation for the researchers means clearly a comparative measure to evaluate one researcher's performance ability and qualification, not an absolute measure. And, a little risk can be included in quantifying the intellectual ability of researchers. Even so, it will be necessary for the managers to analyze and evaluate the researcher's intellectual level, and plan a program for the qualification enhancement.

Suppose that the N factors will be contributed to the degree of technology accumulation. They are labeled as $x_1, x_2, \ldots\ldots, x_n$. Then, the degree of technology accumulation y can be expressed as their linear combination as follows:

$$y = a_1 \cdot x_1 + a_2 \cdot x_2 + \cdots\cdots\cdots + a_n \cdot x_n \qquad (1)$$

where a_i are the weighting factors to evaluate the degree of technology accumulation.

The academic degree, the career, the qualification certificate, the research paper and the research performance can be included in considering the relevant factors. Also, there can be the oversea's training experience, all kinds of education and seminar, the good command of foreign language.

For ease of understanding, let's follow the process to evaluate the degree of technology accumulation with the above 8 relevant factors.

Above all, the process to quantify each factor will be as follows :

(1) the academic degree

$$X_1 = \begin{cases} 4 & \text{when acquired the bachelor degree} \\ 4+1 & \text{when acquired the master degree} \\ 4+1+4 & \text{when acquird the Ph. D degree} \end{cases}$$

(2) the career

X_2 = (the number of career years)

(3) the qualification certificate

$$X_3 = \begin{cases} 1 & \text{when acquired the qualification certificate} \\ 0 & \text{otherwise} \end{cases}$$

(4) the research paper

$$X_4 = \begin{cases} 1 & \text{when it was reported alone} \\ 0.7 & \text{when it was reported by two} \\ 0.5 & \text{when it was reported by three or more} \\ 0 & \text{otherwise} \end{cases}$$

(5) the research performance

X_5 = (the value to quantify this term, $0 \leq X_5 \leq 1$)

(6) the oversea's training experience

X_6 = (the number of experiences)

(7) the education and the training

X_7 = (the number of participating in them)

(8) the command ability of foreign language

$$X_8 = \begin{cases} 1 & \text{when passed the qualification exam. (if possible).} \\ 0 & \text{otherwise} \end{cases}$$

Note that the above values to each factor can be varied as the evaluation methodology. The reason for quantifying the variable X_1 as given is to remove the ironical phenomenon that one researcher with 2 year's carrer after acquiring the bachelor degree has double the degree of technology accumulation compared to the other researcher with 1 year's career after acquiring the same degree, if not, when the remaining factors have zero values.

Now, let's consider the weighting factors a_i. It can be interpreted as the contribution ratio of factors to the degree of technology accumulation, it's not simple to decide these ratios. There can be two methodologies in deciding these values. The one is to follow the top manager's decision. The other is to decide the ratios through the statistical techniques (e.g. simulation techniques).

For example, in this paper, suppose the top manager has decided that the above factors be contributed to y linearly. And, one researcher has one year's career after acquiring the bachelor degree. In that period, the researcher reported two research papers by himself. And, suppose that he has passed the English Qualification Exam. (LATT).

Then, the degree of his technology accumulation will be computed as follows:

y = 1x4 + 1x0 + 1x0 + 2x1 + 1x0 + 1x0 + 1x0 + 1x1 = 7

III. COMPUTERIZATION

The UNIX operating system has its own prospects in many fields nowadays. As the INGRES DBMS is installed in UNIX, it will be desirable to apply this system as a means for constructing a data-base, retrieving the information and computing the degree of technology accumulation.

It has the advantage of being composed of the relational data-base system–the Table Format. This enables the users to use this system more conveniently.

III-1. Procedure

(1) gathering the basic input data

(2) data input

For the initial input, there can be two methods as follows:

i) to input the data directly in DB, or

ii) to form the database using "Copy" command after inputing data using vi Editor.

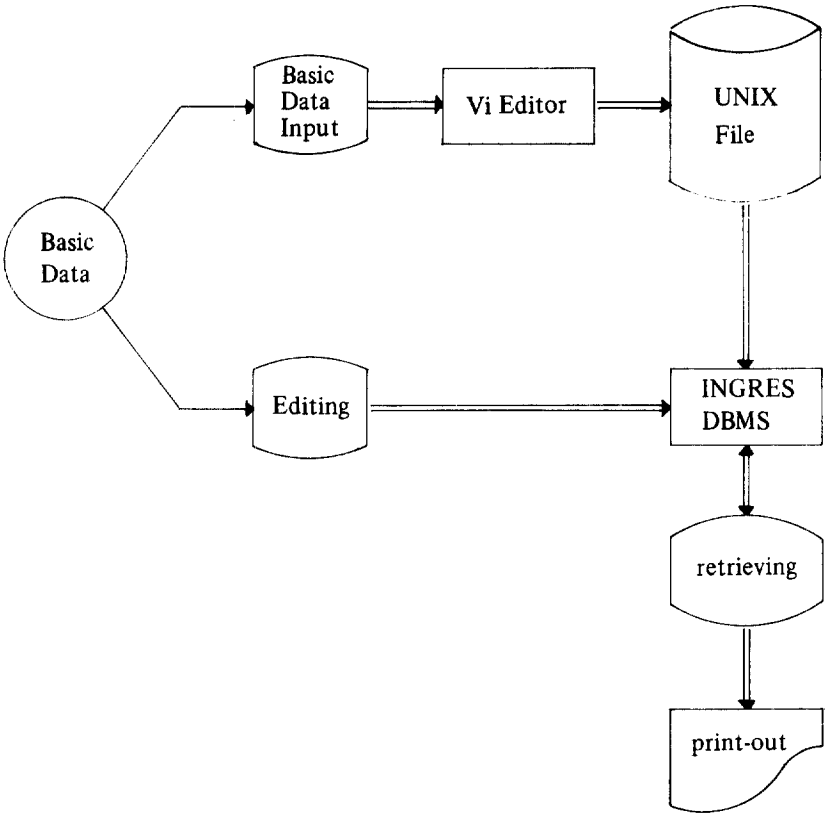
For the additional input and the edition, it is desirable to use the "Append" command in INGRES system.

(3) designing and constructing the database

The INGRES database system consists of the relations, they logically means the Table-Format. Therefore, it is desirable to design the input-format of the same structure. The detail description is given in the following section.

(4) retrieving the information

The flow-chart for these procedures is given in [Fig. 1].



[Fig. 1] Procedures for Computerization

III-2. Actualizing the database

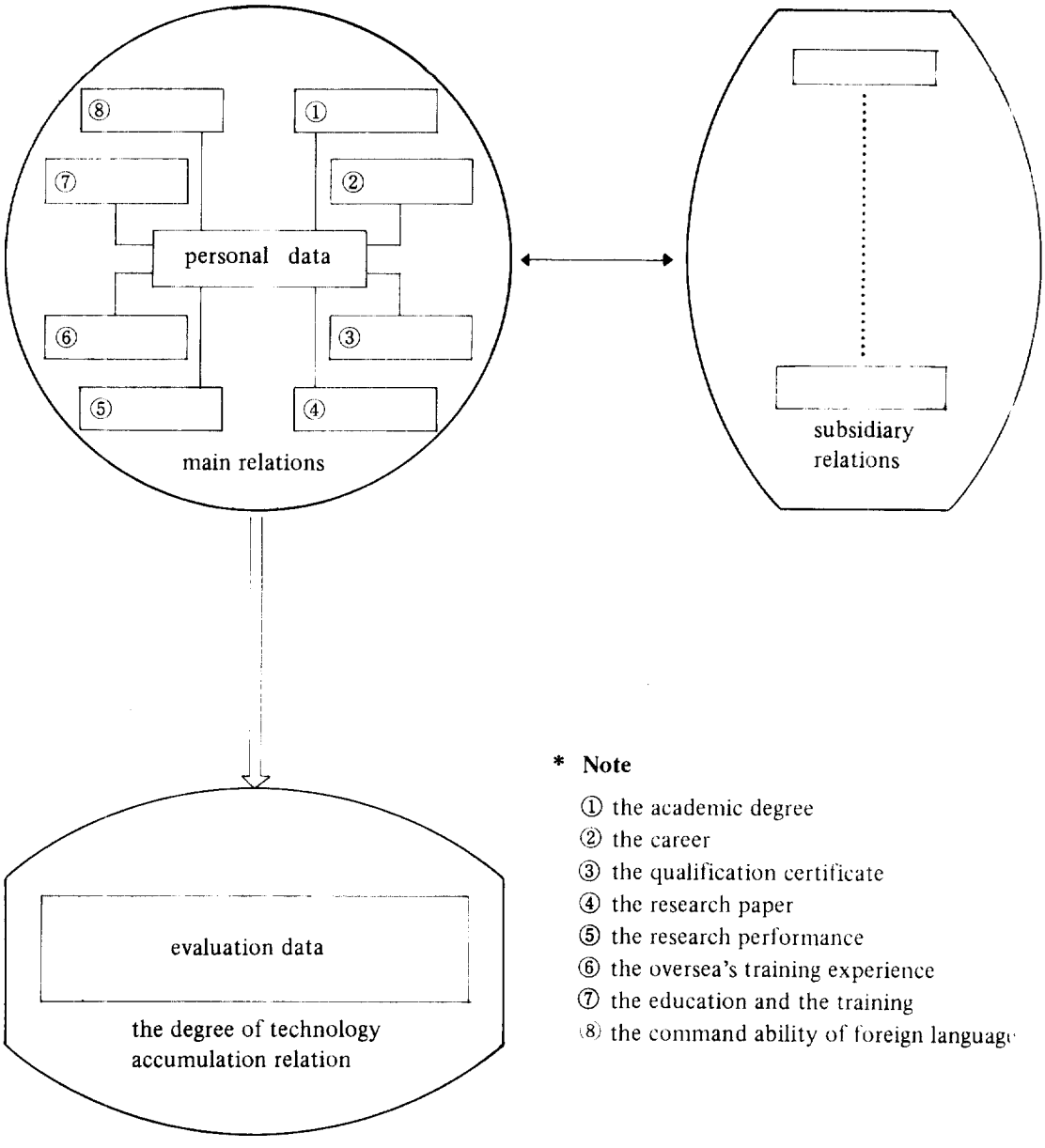
This data-base system consists of main relations (by the basic data), subsidiary relations and evaluation relation for the degree of technology accumulation.

The main relations is the set of data enlisted, and the concerned concrete data is inputed in a relation that has the Table-Format. The detail contents about the internal status of the main relations is enlisted in the subsidiary relations.

The evaluation relation for the degree of technology accumulation consists of the data that can be used in evaluating the degree of technology accumulation among the informations enlisted in main relations.

·The data-base to retrieve the desired information will be constructed after enlisting the inputed data to these relations as designed. And, the evaluation relation for the degree of technology accumulation will be formed by applying INGRES DBMS to the main relations.

The abstract structure will be depicted in [Fig. 2].



[Fig. 2] Database Structure

IV. CONCLUSIONS

The objective of this research is to present a possible method for the degree of technology accumulation management to comply with the drastic development of our industrial society. As a tool in designing and implementing the database and retrieving the desired information, INGRES DBMS has been applied because it is the only available DBMS under the UNIX operating systems.

For this purpose, an evaluation model has been suggested and verified to measure the degree of technology accumulation.

In conclusion, this research is to present a method to measure the degree of technology accumulation to develop the optimum strategies and management programs appropriate to R&D organizations and finally to maximize the utilization of manpower in R&D projects. A more rational method to approach the optimal evaluation model through the further study of these concerns should be made, as suggested in this paper, to keep pace with the advancements of our industrial society.

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